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UNITED NATIONS
ECONOMIC AND SOCIAL COUNCIL

Distr.: GENERAL
E/ECA/CM.13/10
9 March 1987
Original: ENGLISH

ECONOMIC COMMISSION FOR AFRICA

Eighth meeting of the Technical Preparatory Committee of the Whole

Addis Ababa, Ethiopia
13 - 20 April 1987

Item 6 of the provisional agenda*

ECONOMIC COMMISSION FOR AFRICA

Twenty-second session of the Commission/ thirteenth meeting of the Conference of Ministers

Addis Ababa, Ethiopia
23 - 27 April 1987

Item 5 of the provisional agenda**

LG/NAIROBI

INTERNATIONAL YEAR FOR THE MOBILIZATION OF FINANCIAL AND TECHNICAL RESOURCES TO INCREASE FOOD AND AGRICULTURAL PRODUCTION IN AFRICA

* E/ECA/TPCW.8/1

I. INTRODUCTION

A. The food and agricultural crisis in perspective

1. Over the last two decades, Africa has gradually lost its ability to feed its population and finance its investment for its agricultural sector. It is increasingly depending on industrialized countries for its needs. At the same time, earnings from major export crops have drastically fallen while external debts of many African States have multiplied over the last decade. Sub-Saharan Africa is the poorest part of the world's economy, the only region where the rate of growth of population is increasing and where average per capita income is likely to continue to fall during 1985-1995, involving an estimated fall in per capita GDP of 0.7 per cent. 1/ The logical question, therefore, is whether there is any hope for the people of Africa? The answer is "yes" provided, of course, that African Governments and people are prepared to meet the challenge. A look at Asia will, to some extent, place Africa's problems and challenges in a clearer perspective than the gloom-laden predictions taken in isolation.

2. In the early 1960s, India was in the same plight as sub-Saharan Africa today - it was unable to feed its population. But today, India is self-sufficient in grain and actually donated 100,000 tons of grain to African countries in 1985. It has over 17 million tons of grain in storage and is exporting wheat. Although India still has a large proportion of malnourished people, it has shown how a consistent set of pro-agricultural policies supported by complementary investments in rural roads, irrigation research, and the development of a new system of agricultural universities has contributed to a fundamental transformation of agriculture. Of course, there are major structural and socio-economic differences between India and Africa, but the comparison does highlight Africa's physical potential which can enable it not only feed its 450 million people but also generate enough foreign exchange and sustain employment in other economic sectors. 2/ The issue is how to exploit this potential. The current crisis provides the catalyst for a long overdue re-examination of agriculture's role in African development.

3. The serious food and agricultural situation in Africa has been reflected in various forms: in some countries, especially in the Sahelian zone, large human and livestock populations have been displaced. Many countries of the region which once were net exporters of such commodities as palm oil, cocoa, sisal, groundnuts and cereals have either lost ground in the world markets or have become major importers of these commodities. Other countries which were once the breadbaskets of Africa, now survive mainly on food imports. Indeed, international assistance to Africa has reached a point where per capita aid levels are the highest in the world. The 1985 aggregate food aid requirements of the 21 countries with acute food shortages were estimated at 7 million tons (up from 5.3 million tons in 1983-1984.

4. However, with improvements mainly in weather conditions, growth in food production in 1985 and 1986 combined was more than 8 per cent 3/ thus reducing the food aid requirements in sub-Saharan Africa estimated at 1.21 million tons of cereals in 1986-1987. Despite this overall improvement, localized but nevertheless serious food problems still linger on in Africa with some seven countries still facing abnormal food shortages.

5. The dramatic slowdown in per caput food production and the value of agricultural exports (both of which grew at -1.040 per cent in 1980-1985 and -3.996 per cent in 1980-1984 respectively) has had serious consequences: high and escalating food prices, mounting debts and debt-servicing problems and widespread poverty and malnutrition. It has been estimated that more than 150 million people in Africa suffer from hunger and malnutrition. 4/ Of 39 countries in Africa with per capita DES 5/ below minimum requirements in 1969-1971, as many as 28 still had a per capita DES below minimum requirements in 1979-1981. 6/

6. The main causes of the crisis are well known. This paper highlights only the salient factors. While drought, floods and other natural disasters in 1969-1973 and 1981-1984 brought the crisis to the open, and population growth adds to pressure on resources in specific areas, the main immediate causes are the policies and development strategies (both national and international) which have denied agriculture its priority place as an engine of development. 7/ Underlying these is the interplay of a number of deep-seated factors - political, social, technical and economic (especially the energy price changes and the global economic recession) - which have been working over the longer term. Many African States have pursued extractive policies because of the misunderstood role of agriculture in national development and this has resulted in unfavourable terms of trade, insufficient funding and a high burden/benefit ratio in the agricultural sector.

B. Need for medium- and long-term actions

7. Africa's food crisis is part of an overall agrarian crisis which is manifested in malnutrition, poverty, underdevelopment and growing food dependency on industrialized nations. To end hunger and poverty, governments must bring about a fundamental reordering of short-, medium- and long-term development strategies in favour of agriculture. Donors also have an integral part to play in helping to solve Africa's agrarian crisis, through re-examining the role of aid, making fundamental reforms in donor assistance and strengthening indigenous African capacity in the development and application of science and technology to tackle the major problems of African agriculture: low productivity, fragile ecosystems, limited land and water resources development, poor management, extensive crop and livestock diseases, high food losses and weak delivery systems. (The short-term food emergency programmes, although essential for immediate survival, are beyond the scope of this study).

8. This paper concentrates on three critical problem areas:

(a) Strengthening indigenous scientific manpower;

(b) Strengthening national technological and research services in order to generate and diffuse more technology within Africa and rely less on technology transfer; and

(c) The mobilization of domestic and international financial resources to assist African agricultural development.

9. The first two areas have been neglected by African States and donors alike because they have over-emphasized direct technology transfer and the overseas training of agricultural scientists, and investment in international

agricultural research centres. Twenty-five years is the minimum period for building and strengthening Africa's core institutions and mobilizing science and technology for African agriculture.

C. An international year for Africa and the challenge

10. World attention is focused on Africa because of the devastating famine and poverty. The nature and dimension of Africa's crisis has captured the interest of the whole world as never before and hopefully, never again. This report seeks to encourage the international community to mobilize resources to combat African hunger and poverty.

11. Its major concern therefore is to elaborate action-oriented proposals in respect of an international year for the mobilization of financial and technological resources to increase food and agriculture production in Africa (or the International Year for Africa - IYA) which has been proposed for 1991 by the United Nations General Assembly. Although 1991 might be designated the International Year, this should however be regarded as the target year for the celebration of activities which should commence immediately, and also act as a pivotal year for launching the long-term remedial plans over the next two to three decades. Such is the urgency of Africa's agrarian crisis that the preparation for mobilization should not be delayed.

12. The United Nations General Assembly, in adopting resolution 38/198, noted with alarm the gravity of the food situation as evidenced by a drastic decline in self-reliance in food. The General Assembly is fully aware that foreign assistance can play a critical role in third world development if additional resources are also mobilized at the same time. And the Assembly also recognizes that technological stagnation in Africa has direct relationships with declining agricultural productivity which is aggravated by natural factors such as drought and desertification. This report examines in greater detail the technological and financial problems in African agriculture and proposes an action plan for helping African States to redirect policy attention to agriculture, to mobilize more internal resources for agriculture and to provide an economic policy environment conducive to the more effective absorption of foreign assistance.

13. The report also takes account of Africa's Priority Programme for Economic Recovery (APPER), 1986-1990 2/ and the United Nations Programme of Action for African Economic Recovery and Development (UN-PAAERD), 1986-1990 2/ in which African countries with the support of the international community commit themselves to invest greater resources in the agricultural sector and introduce policy changes and necessary structural adjustments which would make them less vulnerable to future emergencies as well as lay the foundations for self-sustained economic growth and development.

II. THE PROBLEMS OF TECHNOLOGICAL DEVELOPMENT IN AFRICA

A. The role of technology generation in African agriculture

14. Despite enormous physical production potential, the rate of growth of food production in Africa since 1970 has been only half the rate of growth of population. Three decades of historical experience in the third world has shown that no single factor - capital, weather, population or technology - by itself can explain agricultural change or stagnation. But there is

widespread and consistent empirical evidence that technological change is one of the four or five prime movers or strategic components of modernizing agriculture.

15. One may start by focusing on a central element of technological innovation, namely crop research. Advances in this field have had such dramatic consequences in Asia that, in the face of the African crisis, any serious analysis of the role of technology in redressing the situation in Africa has to take account of it. This is explored further in section B below; here it is sufficient to note that within six years (1960 to 1966) the International Rice Research Institute (IRRI) produced a new rice variety (IR-8)that dramatically increased yields in the Philippines, India and other Asian countries. In the same decade new wheat varieties from the International Wheat and Maize Improvement Centre in Mexico enabled India to double total wheat production in eight years - a remarkable achievement that no other major country in the world has matched.

16. Criticism of the Asian green revolution has centred on its economically and socially differentiating consequences - although recent research has shown that both small and large farmers in general adopted high-yielding seeds at more or less equal rates, with similar gains in efficiency. The more pertinent criticism is that the quantum leap achieved in Asia is peculiar to the advanced, highly intensive peasant farming culture which has evolved on that continent over generations. But those who doubt the wisdom of tackling the challenge of Africa through a sufficient investment in technology have to face up to three important considerations - the global record of returns on such investment; the historical role crop research has played in Africa; and the potential for an incremental change via broad technological adaptation that agriculture in Africa offers. What is pre-eminently required is the vision to back this up and follow an effective strategy through, not just over one or two years within the confines of a narrowly defined project, but over the long term. These arguments are briefly reviewed.

17. There is common agreement today that agricultural research is a profitable investment activity. More than 50 empirical studies of the rate of return on investment in agricultural research are now available from industrialized countries and from Latin America and Asia. These studies consistently show that the rate of return on investment in agricultural research is high - between 40 and 60 per cent. What is surprising is that the 50 studies of rates of return on agricultural research do not include any samples from Africa.

18. Four important insights emerge from the African historical record. First, improved varieties of cotton, groundnuts, oil palm, coffee and tea helped open up Africa's rural economy and provide economic opportunities for millions of farmers. For example, there are today approximately 18,000 smallholders producing tea in Kenya. Second, the green revolution type of breakthrough was achieved in oil palm in Zaire in the 1960s, in hybrid maize in Zimbabwe in the 1950s and in Kenya in the mid-1960s respectively. Although these important breakthroughs have not been widely publicized in the scientific literature or popular press, they do illustrate the role that long-term agricultural research can play in producing new technology from within Africa. Third, the historical experience indicates that with the exception of hybrid maize research in Zimbabwe (1932-1949) and in Kenya (1955-1964), most research during the colonial period concentrated on export crops. Fourth, the empirical record shows that the average period of time from the inception of research to the release of new technology is about 10 years. Hence, the time span

for agricultural research to meet today's agrarian crisis requires long-term investment programmes and long-term and consistent support from both African States and donors.

19. There are further insights which can be derived from this brief review of developments within Africa, which relate particularly to the development of food production. Post-colonial governments have continued past emphases in agricultural research - with some diversification - but the agricultural research systems have been weakened by the absence of strong lobbies demanding effective research. The small farmers have by and large been badly organized and have limited access to political power. Resource-rich farmers have often seen farming as an extension of their mercantile interests, aiming at short-term profitability rather than long-term viability. Existing research systems are often now in need of rehabilitation.

20. These considerations underline the conclusion that not only are long-term commitments to technological development in Africa feasible and worthwhile, but also that they need to be based on African conditions - the situation of the vast mass of Africa's producers on the land, and that continent's specific and multifarious variations of culture and ecotype. This raises the question of how far technology transfer is an option for achieving fundamental progress in African agriculture.

B. Technology transfer: theory and practice

21. When 16 African States won their independence in 1960, there was great optimism about bypassing stages of development and catching up with industrialized States. Technology transfer played a central role in fuelling the expectations that African States could adopt technology to modernize both its industry and agriculture within a relatively short period of time. Hence, at independence, it is natural that African States and donors turned to technology transfer and imported improved crop varieties and livestock breeds to modernize agriculture.

22. The theoretical case for technology transfer is straightforward. There is a proven payoff to scientists working in research teams, task forces and institutes. It is assumed that the output of these research groups - improved technology - can be transferred through the public and private sectors to clients in other geographical settings. Because of the small and often times misallocated pools of trained agricultural scientists and the poor conditions under which they work in most African countries, the concept of importing ready-made technology is an attractive proposition. Tied aid also encourages importation of foreign technology.

23. An analysis of technology transfer in practice has shown that numerous plant breeders - e.g., oil palm, cotton, maize - have benefitted from imported technology over a span of many decades. But in many countries there is a gap between technology transfer in theory and in practice. Many of the International Agricultural Research Centres (IARCs) operating in Africa have concentrated mainly on the direct transfer of improved plant varieties and have not spent as much time as on capacity transfer - i.e., helping national research services and universities develop their own scientific capacity to screen and borrow technology as well as to adapt it to location specific environments and to attract and retain national trained manpower.

24. It remains the case that most donors have seriously underestimated the variability in African agriculture and the indigenous science capacity required

to achieve the full potential of borrowing technology (via transfer) from the global research system. The uncritical acceptance of the direct transfer of technology creates the comfortable illusion among many donors that it is both possible and feasible to circumvent the long, arduous and costly process of strengthening applied basic research capacity within national agricultural research services and in African universities. But Africa's experience with this form of technology transfer in the last 25 years as adds further evidence to the well-established conclusions that only a country that establishes its own research capacity in agriculture can gain full access to the advances in knowledge that are available to it from the global scientific community and embody that knowledge in the technology suited to its own resources and cultural endowments.

25. In summary, importing technology is critically shaped by the stage of economic history of a particular nation. At this stage of Africa's development, the gap between technology transfer in theory and practice is partly a function of limited administrative, managerial and indigenous scientific capacity. Unfortunately, long-term support for strengthening indigenous scientific capacity is receiving low priority by most African States and by donors who are, for the most part, locked into conservative three- to five-year project cycles.

26. One of the common perceptions among donors is that there is a backlog of farmer-tested technology on the shelf in Africa and that the challenge is how to disseminate this technology to farmers. As regards food crops, the evidence shows that with the exception of maize in Eastern and Southern Africa, hybrid sorghum in the Sudan and the development and popularization of cassava varieties and streak-resistant maize in some parts of West Africa, there is little farmer-tested on-shelf technology waiting to be extended. There is also growing evidence that the genetic resources base is being depleted in export crops, notably cocoa, oil palm and rubber. This erosion is partly a function of shifts in research priorities to food crops, but also partly because of the lack of experience of Africa's young scientists.

C. Implications for technology generation within Africa

27. In the 25 years since independence, much has been learned about agricultural development and the role of science and technology in the transformation of African agriculture. There is consistent empirical evidence that technology transfer - especially biological and chemical - has been oversold and technology generation within Africa has been undervalued by African States and by donors. Moreover, many African States have been unable to exploit technology transfer because they lacked a critical mass of resources and well-motivated agricultural scientists to screen and transfer technology from neighbouring States, regional research networks and from the global research network. Technology transfer, although an important component of agricultural development in Africa, should not be solely relied upon to solve Africa's agrarian crisis.

28. It has been pointed out that under conditions of rapid population growth, and the closing of the frontier, there is need to step up expenditure of agricultural research within Africa in order to generate a continuous stream of agricultural technology for the intensification of agricultural production. The 25 years of independence has also shown that agricultural policy makers in Africa should not sit back and assume that the 13 IARCs will supply African

States with new technology. Although the IARCs have role to play in the global system, they are not a substitute for a strong national research service. The overall conclusion is that greater attention will have to be given to strengthening Africa's indigenous scientific capacity for technology.

29. The implications for African States and donors are clear. Investments in both food and export crop research, especially in the former, for the broad range of rural producers will have to be dramatically accelerated in most African States. Without indigenous agricultural research producing a continuous stream of new technology, the race between the growth of food production and incomes and the growth of population in Africa will not be won.

III. REQUIREMENTS FOR TECHNOLOGY GENERATION AND DIFFUSION WITHIN AFRICA

A. Choices to be made

30. Since research is an activity with a long gestation period, some hard choices need to be made on research priorities. It is argued here that commodity research - on food and export crops - should receive high priority because this type of research has the capacity to generate new income streams and rural employment. Supporting research on land, moisture, water conservation, investment in rural infrastructure and extension are also needed to facilitate the introduction of adapted farming systems, effectively supported by technical developments in crops and livestock.

31. The balance between basic science research, applied research, farming systems research and farmer-led research will depend on circumstances. However, in all cases, major attention will have to be given to keeping the scientists and farmers involved in different types of research in collaboration with each other. In most cases only applied research has received much attention. The limitations on technology transfer have already been mentioned in section II. Choices must be made about the forms of research too. In the past, research has focused on pests and diseases. Although agronomic research on food crops was stressed, it tended to neglect practical farming considerations of resource-poor, risk-prone farmers such as labour availability and inter-cropping. Mechanization, harvesting, storage and economic aspects also received inadequate attention. 10/ More importantly for Africa, the whole question of how communities can use resources has too often been omitted from research agendas.

32. This paper argues that the sustainability of production systems has been neglected. Emphasis has been on the individual farmer (whether rich or poor) and there has been little consideration of the way resources will have to be managed from a communal - national or regional - point of view. Too short-term and profit-oriented a view of production systems and research has been adopted. Generating sustainable systems requires a combination of the four types of research mentioned above. In practice, since most countries have already some plant selection and breeding capacity, priority should now be given to basic and applied research in soil and water dynamics and management, appropriate mechanization, mixed farming especially the draught animal issue, inter-cropping and rotations, organic fertilization, integrated pest management, development and introduction of appropriate varieties (including drought-resistant varieties) and measures to combat desertification. It is clear that basic research will be largely ineffective without the critical mass of scientific personnel and financial resources that may lie beyond a

country's capacity. Regional collaboration is certainly needed. Any regional research programmes will have to find ways by which any member country will feel that it has sufficient power and control to ensure that its priorities and problems are addressed.

33. However, among the most serious problems limiting the effectiveness of research in Africa are the weak delivery systems which fail to ensure that technology packages developed at the research centres reach the farmer so that they can be adopted and applied. This reinforces the need for more efficient delivery systems and better research. The weak linkages between research, extension and the farmer critically retards the development and diffusion of technology so imperative to progress.

34. More difficult choices concern the target groups for research investment. Given the importance of resource-poor farmers in all African countries, greater attention than at present should be paid to investments in research which is specifically targeted on the problems of resource-poor farmers. Even basic science research topics (e.g., soil dynamics) need to reflect some of the major problems faced by small farmers (including women).

35. Given the past bias of research on high potential areas, the distribution of poverty and vulnerability to hunger, it is logical to focus greater investments in the remoter, marginal agro-ecological zones, which nevertheless support substantial populations. These considerations call for a rethinking of technological policy so as to focus attention and resources on these areas - some of which have either been neglected in the past or have not received adequate emphasis.

B. Stepping up basic research in Africa

36. During the last two decades, donors have commited generous support to the IARCs. And donor investment in applied research in the IARCs and national research services will probably total several billion dollars over the period 1980-2000. Despite the fact that most of the IARCs are based and operating in Africa, only the International Laboratory for Research on Animal Diseases (ILRAD), the International Institute of Tropical Agriculture (IITA) and to some extent the International Livestock Centre for Africa (ILCA) are committed to basic science research. While the other IARCs are concentrating on applied research and shorter term studies, ILRAD is concentrating on long-term research on two livestock diseases, trypanosomiasis and theileriasis (East Coast fever), that principally affect cattle in Africa.

37. The almost exclusive support for applied research and modest investment in basic science research in African universities and research institutes by donors assumes that technology transfer and applied research are adequate to solve problems of African agriculture. But the technical problems which beset agriculture in the region are such that only concerted and interactive efforts in long term basic science and applied research can effectively deal with these problems. Although IITA, ORSTOM and IRAT programmes in West Africa give attention to basic soil research as they relate to crop husbandry practices, it is evident that research on low soil fertility and water resources development and management are some of the areas which require inputs from basic science research. In fact, a need is already felt to strengthen soil research in Africa. The solution of the African food and agricultural crisis also requires research and better knowledge of agro-climatology. Apart from the activities of the above-mentioned research organizations, the contributions

of SAFGRAD, ICRISAT, WARDA, etc., should be noted. In particular, the work done by ICIPE in integrated pest management and immunology is of great importance and needs to be fully supported.

38. The International Year for Africa (IYA) provides a good opportunity for assessing the state of the art of basic and applied science research in support of agriculture in the region, the adequacy of basic science research in the IARCs, national services and universities in Africa and the transferability of basic science ressing thetput from the industrialized countries to agricultural research institutes in Africa. Results of such studies would guide donors on the mix of basic science and applied research for the next 20 to 25 years. It must be mentioned, however, that some of these activities are already underway in the SADCC countries under the co-ordination of the Southern Africa Centre for Co-operation in Agricultural Research (SACCAR) based in Botswana.

39. One caveat about basic science research is that it is often remote from urgent problems in the field. University researchers are typically isolated. A greater effort needs to be made to associate basic with applied researchers and also with technology users. Lessons could be learnt from the study of successful organizations in this respect such as the Institute of Agricultural Research, Samaru (of Ahmadu Bello University, Nigeria).

C. Strengthening national agricultural research systems

40. As a measure to strengthen the agricultural research systems, African countries should collect, store and test indigenous plant genetic materials and livestock in addition to adapting technology developed outside their countries. In some fields there may be no technology to import in ready-made form (e.g., soil conservation, organic fertilization), and in others there may be no reason not to use local material.

41. Also, there is a great need for research station scientists to be directly involved in on-farm activities and for farmers to play a role in research. Farmers should be involved in helping to set the agenda for research, and in carrying out some of the on-farm trials. More research should be carried out on farm rather than at station, given the great variability of natural and socio-economic conditions from one micro-area to another. Farmers can be involved in activities of local experimental stations.

D. Training to strengthen indigenous scientific capacity

42. Whereas much attention has been paid to Africanize the civil service, industry and commerce, much less emphasis has been given to Africanization of universities and research organizations. The result is an acute shortage of African scientists, managers and academic staff in schools and faculties of agriculture, and excessive reliance on foreign technical experts.

43. Donors are aware of the acute shortage of African scientists and managers. But the present practice of sending a large number of African students overseas for post-graduate training can only be a second-best approach in meeting African manpower needs in the agricultural sector since only a surprisingly small number of such students undertake research on African problems during their study programmes. For post-graduate training to be of relevance to African agriculture, it must be pursued in an environment which poses problems and challenges similar to the African experience.

44. Within this context, emphasis must shift the training of African scientists and managers in agriculture at MSc and Ph.D levels from industrialized countries to Africa. Post-graduate training should also emphasize practical work and field tasks and researchers' career structures should formally reward field work. Now is the time to effect this change. However, before donors continue with investment programmes to increase scientific and managerial capacity for agricultural development in Africa, the question of higher education in Africa should be examined in depth in a regional study during the IYA. Specifically, data need to be generated on the direct and indirect costs of training students at home compared with the cost of training them overseas.

E. Promising directions for investment research building on existing success

45. There are many promising, but relatively neglected avenues for development, in addition to those commonly being explored already. It is not possible to make a complete inventory of these for different physical or socio-economic environments because experience in Africa remains substantially uncollated. The first priority for research would be to identify the four basic agricultural/food producing situations such as set out below:

(a) Closed productive forest/export crop economy;

(b) Wet savannah;

(c) Dry savannah/semi-arid areas; and

(d) Agro-sylvo pastoral situations.

The next step would be to piece together from secondary sources and from empirical research a picture of available tested or promising technologies. A related task is to work out what factors are responsible for the existence of those research and development organizations which have been or could be relatively successful in the African situation and to communicate the results of both studies widely in the region.

1. Crop and livestock improvement

46. National plant and animal breeding programmes are of course a high priority. However, greater emphasis now needs to be placed on the adequate and continuous assessment of the problems of poor African clients. The delivery system, particularly extension services, should be strengthened to effectively identify and bridge the communication gap between researchers and the farmers. The basis for breeding needs should be shifted substantially from collection and screening of exogenous material to the improvement of local material and breeds. Seed and livestock banks established with the co-operation of farmers and herders are long overdue. The cultivation of multi-purpose tree species can also improve the yield of most arable land as well as that of livestock.

2. Soil quality maintenance and improvement

47. There are opportunities at the farm level for greater emphasis on soil management. Tillage practices, including minimum tillage techniques and adaptation of practices to animal power are important to soil structure and the ability to prevent erosion. Green manuring, the planting of cover crops, and mixed farming are often neglected aspects of soil enhancement and require

both technical and socio-economic studies. Again, farm-forestry has the potential for both income generation, and soil improvement and protection as fuel prices rise. At the community level, the problem of soil erosion and degradation can be tackled by encouraging communities to undertake environmental conservation and community forestry programmes. The establishment of clearer rights in land and the use of food for work programmes can provide proper incentives for mobilizing support for the purpose.

3. Moisture and water conservation

48. Since many of Africa's problems of low yields and erratic production are a result of drought - inadequate or poorly spaced rainfall - special attention is needed for moisture conservation measures. This is true even in higher rainfall areas where tropical storms lead to excessive runoff and erosion.

49. In view of the increased food security which irrigation can provide, small- and medium-scale irrigation, whether from surface or groundwater sources must see increased investment: this can be done in the medium term. A more cautious approach to large-scale irrigation is advocated, given the difficulties of management, the cost and the tendency of large-scale irrigation schemes to displace well-adapted land uses. However, the prima facie case for larger scale irrigation in semi-arid areas is overwhelming. Research is needed to reduce the costs and increase the manageability of large-scale irrigation.

50. Water pumps using solar, wind, biogas, animal and human power have to be popularized. The technologies are available. It is a question of applying these technologies for water/moisture conservation and improved management of water resources.

4. Technologies for storage, transportation and commercialization

51. Technologies for food storage, transportation and commercialization, developed by groups working on appropriate technology, are also available, but little use has been made of them for improvement of the situation. It is well known that nearly 15 to 30 per cent of food produced hardly reaches the consumer because of losses and the problems of storage, transportation and commercialization. Adequate measures, including development of local technologies, are essential in facing these problems.

F. Changes in technology and management

52. The changes in technology and management required to sustain agriculture and livestock production in much of Africa are significant. The challenge is not only to develop the technologies to fill the "production gap", but to develop relevant research systems. These systems would then need to generate technologies which have perceptible benefits to farmers and herders, or to subsidize their introduction, or to restructure incentives so that they do bring rewards. As far as possible increasing land productivity must not be at the expense of labour productivity: the two should ideally go hand in hand. This will not be possible in all cases, so Governments and donor agencies must be prepared for substantial subsidization and/or economic restructuring. Food for work programmes are one form of the latter.

53. Sustainable food and agriculture development in Africa also requires the constructive management of natural resources. At present the State plays

a nominal role in resource management in many cases; communities are rarely expected to play a strong role. States should provide the legislation and administrative framework within which formal control of resources can be delegated to resource users.

54. The reasons for seeking more domestic and international financial resources for science, technology generation and agricultural training within Africa should now be apparent. Considerable and long-term support would be required to tackle the massive problem of re-orienting and greatly strengthening Africa's agricultural research and production systems, develop and strengthen Africa's indigenous scientific and technological capability and bring about a transition from an extractive to a regenerative agriculture.

IV. FINANCIAL RESOURCES FOR AFRICAN AGRICULTURE

A. Past trends

55. This section is concerned with the future financial requirements for sustained agricultural recovery and growth in Africa. Financial resources are treated here in their widest meaning to include both domestic and external flows of investment into the agricultural sector, and also to include the finance required for importation of agricultural inputs and food aid. Special attention is given to Official Development Assistance (ODA) because the types of assistance needed (to support research, training, the provision of physical infrastructure, food security) are not attractive for private investment. This section looks, in turn, at the causes of the severe resource gap confronting African agriculture, recent trends in external resource flows and their adequacy, and future financial requirements for medium- and long-term agricultural sector initiatives.

56. The consideration of future financial needs must be placed in the context of previous trends. It is now widely acknowledged that the agricultural sector in most of Africa was relatively starved of financial resources throughout most of the past two decades. This applied both to public and private finance, as well as to domestic and external resource flows. The share of government development expenditure directed to agricultural sector investment was typically very low compared to the sector's shares of population and gross domestic product. Thus, in the mid-1970s, the share of agriculture in public investment ranged between 15 and 20 per cent for many African countries with shares of the population in agriculture of up to 80 per cent and shares of agriculture in GDP of up to 60 per cent. The same was true of government recurrent expenditure in agriculture which on average was only 5 to 6 per cent of total public recurrent expenditure in the early 1970s, and which declined steeply in real terms at the turn of the 1970s. The low share of agriculture in ODA financial flows is considered further below.

57. The relatively low volume of financial flows into agriculture is not the only problem now recognized with past practice. The wisdom of the uses to which a large proportion of resource flows were put has also been placed in doubt, as also have the institutional structures through which governments interacted with their farmers. In particular, it is considered that past resources were unduly directed to large-scale and prestigious agricultural projects at the expense of small farmers, and that government interventions in the pricing and marketing of agricultural output created severe disincentives

to production growth by small farmers. This is not to suggest that all resource flows into agriculture had negative effects, but rather that the relative emphasis on scarce resource utilization failed to achieve the conditions for the sustained development of the small farm sector which is the core of the agricultural economy in most African countries.

B. Causes of the crisis in financial resources

58. Africa confronts a crisis of financial resources which has been increasing in severity since the early 1970s and which has in part exacerbated the agrarian crisis and made it extremely difficult for any African Government to implement effectively, essential reforms in policies in favour of agriculture.

59. The causes of the widening deficit in financial resources are several, and have both external and domestic origins which escalated during the 1970s and especially in the early 1980s with the onslaught of the drought. The declining agricultural production of the 1970s resulted in lower foreign exchange earnings from agricultural exports and higher import bills for necessary food imports. This worsened the balance-of-payments position of most African countries already pushed into deficit by the external factors resulting from oil price increases and international inflation in manufactures. As prices of most agricultural exports declined after 1980 while import prices continued to rise, African countries witnessed a large deterioration in their external terms of trade.

60. These and related events have had serious repercussions on Africa's external debt which between 1974 and 1984 multiplied sevenfold reaching $US 145 billion in 1984 and $US 200 billion by the end of 1985. 11/ The cost of servicing this debt is estimated at between $US 14.6 and $US 24.5 billion annually while the ratio of debt service to exports reached 30 per cent in 1984, a fourfold increase from 1974. 12/ The existence of debt problems of this magnitude means that a large and growing proportion of Africa's available financial resources must be diverted to servicing past financial obligations rather than investing in agricultural recovery programmes or promoting new productive activity. Clearly, an important component of the discussion of future financial resources will be the need to review with care the debt obligations of African countries.

61. An important factor which exacerbated the decline of agricultural production in some African countries was the maintenance of overvalued exchange rates. These resulted in much too low domestic currency equivalents of international prices for both export and food crops. In some cases they also resulted in the growth of parallel markets and in unofficial transfers of crops across national frontiers. It should be noted, however, that the correction of exchange rate distortions is not unambiguous in its impact: it may be self-defeating due to its adverse effect on the prices of agricultural inputs and on the general level of inflation confronting farmers. Thus exchange rate policy cannot be examined in isolation from other instruments of economic policy and in the present context, it cannot be isolated from alternative potential forms of balance-of-payment support.

C. ODA financial flows

62. While debt is one of the most visible financial constraints facing African countries in the mid-1980s, of central relevance both to the future solution

of the debt problem and to the provision of new resources for sustained agricultural recovery is the volume and composition of Official Development Assistance (ODA).

63. Tables 1 and 2 show ODA commitments and net disbursements respectively for the whole of Africa during the years 1979 to 1984. It is remarkable to note that total commitments to Africa continuously declined between 1980 and 1983 (a fall of 3.9 per cent). On the other hand, actual net disbursements of ODA kept fluctuating over the period 1979 to 1984.

Table 1: ODA commitments from all sources to Africa: 1979-1984

(in millions of US dollars)

	1979	1980	1981	1982	1983	1984
Total Africa of which	11 107.1	13 299.1	13 059.4	12 943.7	12 552.6	14 044.3
South of Sahara	8 133.6	9 930.9	9 384.0	9 649.4	9 749.0	10 164.4
North of Sahara	2 792.9	3 266.8	3 474.3	3 064.2	2 542.9	2 906.4
Africa unspecified	180.6	131.4	201.1	230.1	260.7	974.0

Source: FAO, Computerized data bank on external assistance to agriculture, 12.[illegible]86.

Table 2: Net disbursements of ODA to Africa: 1979-1984

(in millions of US dollars)

	1979	1980	1981	1982	1983	1984
Total Africa of which	8 871.6	10 429.6	10 471.0	10 525.1	9 993.5	11 14[illegible]
South of Sahara	6 424.8	7 547.1	7 512.1	7 756.4	7 533.9	7 830.2
North of Sahara	2 254.8	2 710.9	2 751.5	2 557.6	2 237.9	2 358.5
Africa unspecified	192.1	176.6	207.4	211.1	221.7	959.7

Source: OECD's Geographical distribution of financial flows to developing countries.

64. Concerning agriculture, official commitments of external assistance to this sector in developing countries has been generally low - about 24 per cent of total official commitments from bilateral and multilateral donors during 1979-1980 to 1982-1983. 13/ Available data for Africa (table 3) show that such commitments of external assistance to agriculture, excluding technical assistance grants, were not only low but actually fell (in the case of OECD's broad definition of agriculture) from $US 3.4 billion in 1982 to $US 2.8 billion in 1984. This, and also the fact that actual disbursements must have fallen

far short of commitments as is usually the case, demonstrates the extent to which African agriculture has been starved of financial resources over the past two decades.

Table 3: Commitments of official assistance (concessional and non-concessional) to agriculture in Africa: 1980-1984

(in millions of US dollars)

	1980	1981	1982	1983	1984
Broad definition	2 631.5	3 097.5	3 413.3	3 091.0	2 821.8
Narrow definition a/	1 603.9	1 905.2	1 599.7	1 913.7	1 850.7

Source: FAO, Computerized Data Bank on External Assistance to Agriculture; 12.8.86.

a/ The narrow definition of agriculture excludes forestry.

D. Resource requirements and utilization

65. A discussion on resource utilization must, by necessity, precede the estimation of resource requirements since the broad areas for which enhanced real financial resources are urgently needed and on which future effort should be concentrated must first be identified. APPER provides the framework within which any programme of action for the rehabilitation and development of African agriculture must focus on. Within this context and, taking into account the conclusions reached in sections II and III of this report, these broad areas are: (a) increased food production; (b) arable land development and land improvement; (c) livestock and animal product development; (d) mechanization; (e) storage and marketing; (f) agricultural research, manpower training and extension; (g) water resource management and low cost irrigation schemes; and (h) reafforestation programmes and drought and desertification control. Following these, the next in priority is the incentives as well as the strengthening of other sectors that support agriculture.

66. As regards future resource requirements, it is extemely difficult to make accurate estimates, given the complex financial situation faced by African countries at the present time. Emergency relief, either in the form of food aid or in general import support, becomes confused with longer term requirements and mounting debt-service obligations tend to substract from new finances which become available. Fortunately, however, for Africa financial estimates have been made on a country-by-country basis, the total cost of the national priority programme formulated in the context of APPER, 1986-1990. The food and agriculture target for APPER during the five years 1986-1990 has been calculated at $US 57.4 billion or 44.8 per cent of the total implementation cost of APPER. This implies that the broad areas identified above in the food and agricultural sector would require an expenditure of $US 57.4 billion in the coming five years. Of this amount, the African countries have fully commited themselves to make available from domestic sources $US 40.3 billion, leaving a gap of $US 17.2 billion to be supported by the international community.

67. A key element in this paper has been the emphasis on the importance of agricultural research in the development of appropriate technology for food and agriculture in Africa and the necessity for a substantial increase in financial resources devoted to agricultural research. APPER, unfortunately, does not provide any indication of the share of research in the allocation of $US 57.4 billion to agriculture. To provide an estimate of the future financial requirements for national agricultural research systems in Africa in the years ahead, this paper resorts to the conclusions and recommendations of a UNDP/FAO study on national agricultural research in selected developing countries. 14/ That UNDP/FAO study recommends, after a thorough analysis of all relevant evidence, that in order to bring about sustained development and growth in African agriculture, expenditures on agricultural research should reach 10 to 20 per cent of the total funds committed to agricultural development and at least 1 per cent of agricultural GDP. 15/

68. Within the context of APPER, the recommendation that 10 to 20 per cent of total funds committed to agriculture should be devoted to research calls for an investment outlay of between $US 5.74 and $US 11.48 billion in the African national agricultural research systems in the five years, 1986-1990. This represents an annual investment of $US 1.2 to $US 2.3 billion and a fair estimate of the resources required to bring about the necessary reforms in research discussed in sections II and III of this report. 16/ Since the time frame for these reforms to bring about sustainability in development and growth in the food and agricultural sector in Africa is 25 years, it will be necessary to maintain an investment of this magnitude throughout this period.

69. To support an investment of $US 2.3 billion per year which is the desirable upper limit for a technological breakthrough, African Governments would have to make sacrifices including the intensification of services in support of research while increasing the absorptive capacity of this quantum increase of resources through greater linkage between research, extension, the universities and other related services. However, whatever sacrifices Africa is committed to make, it certainly cannot provide all the resources required to lay the foundation for the structural transformation of the agricultural sector and indeed the whole African economies. Therefore, the international year for Africa should provide the international community an opportunity to support APPER.

V. PROPOSALS FOR ACTION PLAN: INTERNATIONAL YEAR TO END HUNGER AND POVERTY IN AFRICA

A. Strategy, principles and programme for the international year for Africa, 1991

1. General considerations

70. Activities during the international year for the mobilization of technological and financial resources for food and agriculture in Africa (or the International Year for Africa - IYA) must have as their basic aim the communication to African policy makers and the international community the extreme gravity of the food and agricultural situation in Africa, together with the awareness that there is a real prospect for betterment, given a concerted effort both within and outside Africa. To this end, the following considerations need to be taken into account:

(a) The IYA should have clear and purposive themes;

(b) Actions should be specifically targeted for the mobilization of resources;

(c) It should create and/or strengthen domestic and international structures which will continue at least for the next decade;

(d) Recommended programmes should be accorded priorities on both subregional and country bases;

(e) An effective system of monitoring and evaluating the flow of real resources into African agriculture over the long term should be instituted; and

(f) Given the locationally specific content, IYA will differ substantially from previous international years, and will require appropriate organizational forms; however, the experience gained in the running of previous international years should be drawn upon.

2. Programming and phasing

71. A four-base process of programming for IYA is envisaged:

(a) Phase I: Planning, 1986-1987

(i) First session of the United Nations advisory committee for the International Year for Africa, 1991;

(ii) Consideration of recommendations by the United Nations advisory committee by the United Nations General Assembly;

(iii) Institution of the international secretariat for IYA;

(iv) Establishment of an international trust fund;

(v) Transmission to Member States of the decisions and recommendations of the General Assembly.

(b) Phase II: Preparatory implementation and fund-raising, 1988-1990

(i) Circulation of detailed guidelines, The Programme of Measures and Activities for the IYA international secretariat;

(ii) Establishment of the national co-ordinating bodies;

(iii) National and international campaign for fund-raising and ODA policy review;

(iv) Establishment of the Africa subregional liaison committees;

(v) Institution of surveys and studies in agricultural policy;

(vi) Preparation for the strengthening of agricultural research and manpower training capacity in Africa, and collaboration at inter-State and international levels;

(vii) Preparation of agendas for action, medium and long term, by national co-ordinating bodies;

(viii) Review of priorities, and elaboration of regional programmes by Africa subregional liaison committees;

(xi) Monitoring and evaluation of progress by the United Nations advisory committee.

(c) Phase III: Celebration of the International Year for Africa, 1991

Institution of medium- and long-term programmes.

(d) Phase IV: Monitoring and evaluation of progress, 1992-2000

3. Preparatory activities

72. The year 1991 will be the actual year for celebration; however, it should be viewed as the target year for the achievement of a number of preliminary objectives. Preparation for these should begin as soon as is feasible. These may include:

(a) Commitments by African Governments to solve the problems of the food and agriculture sector by way of policy reforms and allocation of resources. This commitment is already reflected in APPER;

(b) Policy statements and resource commitments by major donors reflecting radically revised strategies of ODA for African agriculture;

(c) Surveys and studies on aspects of agricultural policy which should include recommendations on improving food and agricultural production:

(i) Local and regional commodity and consumer goods pricing strategies;

(ii) Early warning systems and food storage policies;

(iii) The design of monitoring systems on the flow of resources to agriculture on a country-to-country basis;

(iv) Rural transport performance studies;

(v) Identification of marginal agro-ecological zones, and the need for new or adapted land-use systems;

(vi) The examination of 'success stories' in key areas of long-term production sustainability, with a view to replication and extension;

(vii) Investigations of effective measures for the involvement of farmers in the conception, practice and application of research;

(d) Commitments by African States to guidelines and effective systems for the monitoring and evaluation of the real resource flow into agricultural sectors;

(e) Strengthening of new agricultural research capacity in Africa and the re-orientation of existing research programmes;

(f) Expansion of high- and medium-level manpower training facilities in the area of agricultural support within Africa;

(g) Strengthening of collaborative arrangements between training and research institutions both within Africa and between Africa and other participating nations;

(h) Studies of debt service problems, with feasibility analyses of debt collection; and

(i) The commencement of adopter schemes, whereby community groups, schools, farmers' clubs, etc., amongst participating nations undertake a programme of support for a designated African farming community.

4. Staffing and funding

73. In view of the long-run build-up to 1991, particular attention needs to be paid to the question of staffing and funding IYA activities. Resolution 1980/67 of the United Nations Economic and Social Council, which provides detailed guidelines for the conduct of international years, emphasizes (paragraph 21) that:

> "The proclamation of international years and activities connected with them should not lead to a proliferation of costs in the United Nations Secretariat or in the secretariats of other organizations; furthermore, expenditures should normally be met from existing resources in the regular budget."

Paragraph 13 of the same document stresses that in principle, financing should be from voluntary organizations, and that the basic arrangements for financing should be made before the proclamation of the international year.

74. However, in the case of the International Year of Shelter for the Homeless 1987, it was noted that:

> "In view of the wide-ranging nature of the programme of activities planned for the Year, and the need to ensure that support of the centre's secretariat ... does not have a detrimental effect upon the delivery of the regular work programme of the centre, it appears inveitable that some additional but strictly limited resources will be required to provide for substantive secretariat and programme support costs."

75. The extrabudgetary costs were established to amount to $US 4.3 million at 1983 priced for operations and support over the five-year period 1983-1987 (see annex II).

76. There is a clear prima facie case for requesting consideration by the Secretary-General for a limited additional budget item, in view of the very substantial programme of work which the initiating period of IYA will involve. The extent of this will partly depend on decisions made as to which should be the lead agency, and of course, the present financial crisis which the United Nations is facing.

77. As soon as feasible, an international trust fund should be established, and voluntary donations sought for the prepration of activities for IYA.

B. Aims and objectives

1. Programme area

78. This paper recommends that the priority issues for the programme of action during IYA 1991 should be:

(a) The critical review of development strategies and approaches with a view to reconciling those of donors, governments and farmers;

(b) A gradual shift from short-term project-based aid to long-term support for the agricultural sector;

(c) A commitment to long-term research programmes oriented to the needs of small- to medium-sized farmers and herders;

(d) The indigenization of scientific and technological base within Africa for the support of agriculture;

(e) Intensive manpower training primarily within Africa, in broadly defined agricultural support services and management areas;

(f) A radically revised economic environment for the small producer via locally adapted price and marketing policy, and a general alleviation of bottlenecks and scarcities in essential inputs and wage goods;

(g) Substantially increased investment flows into rural transport, small-scale irrigation, groundwater development;

(h) Major attention to the needs of environmental protection, notably soil fertility maintenance, watershed management, forest conservation and expansion; and

(i) Food security provision, through early warning systems, and improved storage and distribution.

2. Themes

79. While these issues may form the basis for elaborating particular programmes, in themselves they are not appropriate as major IYA campaign themes. It is proposed that the central uniting theme be that of mobilizing financial and technological resources for the small peasant farm family, under a slogan such as: "The African peasant farm family to the fore".

80. The purpose here is to display the human, domestic face of agriculture in Africa as a working and living entity, with all its potential for success in the face of admittedly grave problems of under-investment, environmental degradation, population pressure, and insufficient support and technology. This theme will unite a very large number of the various strands mentioned above, and enable a popular identification to be made with the crisis. It should stress the importance of agriculture in the maintenance of a satisfactory standard of livelihood, particularly for the smallest and poorest producers and remote area dwellers. The illustrative components of the campaign - videos, posters, information packs, films, together with such activities as visits and exchanges, farmer festivals and the like - should concentrate on communicating the human face of the problem. The type of programme which might develop activities and measures for this theme would include:

(a) Improved input delivery (rural transport, agencies);

(b) Price and marketing policies;

(c) Small-scale irrigation and groundwater development; and

(d) Research on drought-resistant crops.

81. Subsidiary themes which extend and develop the range of issues identified for priority treatment should perhaps be limited in number, and reflect above all the vision that the crisis in Africa is not insurmountable, provided a concerted long-term effort is made. Such subsidiary themes might include the following:

(a) A new deal for eliminating hunger in Africa;

(i) New financial commitments by major donors;

(ii) Case studies of successful bilateral aid programmes;

(iii) CDA policy review;

(iv) Monitoring programmes for African agricultural sectors.

(b) Protect the land, and protect life:

(i) Land, soil and water management;

(ii) Forest-ecosystem, conservation and management;

(iii) Case studies of successful and unsuccessful conservation and protection measures;

(c) Science for food and agriculture:

(i) Utilizing and developing indigenous knowledge;

(ii) New long-term agricultural research capacity;

(iii) Technology adaptation;

(iv) Collaboration among research institutions.

(d) Developing new skills for a stronger Africa:

(i) Increased manpower training;

(ii) Collaboration among training institutions.

C. Guidelines for organization and action

82. The basic network of institutions is represented in the organizational chart annex I. The key organizations are considered at three levels: national, regional and international.

1. Action at the national level

83. All member nations of the United Nations should be invited to participate in the International Year. Participating members should be invited to establish a trust fund for the receipt of donations towards the International Year both at the official level and also with community and non-governmental organizations. The national co-ordinating body should:

(a) Prepare an agenda for national action in line with the principle and objectives of IYA;

(b) Undertake a thorough review of national ODA towards Africa, and examine the scope for new initiative, particularly as regards the mobilization of additional resources for the agricultural sector;

(c) Invite the active participation of institutions concerned with research and training in tropical agriculture;

(d) Co-ordinate and support the activities of non-governmental agencies engaged in the project and support work for African agriculture; and

(e) Seek sponsorship and other forms of support from voluntary sources.

2. Action at the regional level

84. Action at the regional level, notably multibilateral and inter-State organizations within Africa will have a particularly important role to play for the International Year. There is a danger that the breadth and complexity of the issues across such a diverse continent as Africa will lead to a diffuseness of effort, and even allow potential contributors to claim existing activities as their response to the international mobilization. Accordingly, there should be a clear linkage between regions and programmes, with priority areas for action and the details of implementation elaborated at the regional level. It may be appropriate to invite participating members to link their national activities with a particular regional area of focus, in order to give the campaign immediacy and impact.

85. Subregional liaison committees should be established in each major African zone, whose function will be as follows:

(a) The role of African governments and peoples will be crucial for the success of IYA. They will play a twofold role in increasing domestic resources, and in determining the effective application of these and other resources to agriculture. The decision-making process - involving both State and non-State agencies - which will determine the degree of support which African farm families receive in practice, should be a major target of the campaign. Regional co-operation in such areas as marketing, research, training and transport should also be a major focus;

(b) Consider the zonal priorities within the broad principles of the IYA programme;

(c) Elaborate programmes of activities in detail;

(d) Co-ordinate the activities of external agencies, and arrange for intergovernmental exchanges;

(e) Operate links with supporting participating bodies.

86. The subregional liaison committees may be based at the ECA MULPOCs (Multinational Programming and Operational Centres) as follows:

North Africa	Tangiers
West Africa	Niamey
Central Africa	Gisenyi
West Central Africa	Yaounde
Eastern and Southern Africa	Lusaka

3. Action at the international level

87. The main international organizations are:

(a) Target funding agencies;

(b) United Nations Advisory Committee on International Year for Africa (IYA);

(c) International voluntary organizations;

(d) Other international financial contributors;

(e) United Nations units and organizations;

(f) Designated lead agency;

(g) Support agency;

(h) International secretariat.

88. Target funding from external sources: The IYA campaign has as a major immediate goal the radical increase in funding availability for Africa. The scale of the measures required are set out in the previous section: $US 1.148 billion to $US 2.296 billion per year for national agricultural research systems of which $US 343 to $US 686 million annually would be expected from external sources, 16/ thanks to the international community and its commitments to support and complement the African development efforts. 17/ The campaign should identify the potential sources of these resources and to gear actions in each case. The major targets are:

(a) Major multilateral funding agencies (the IBRD group, UNDP, ADB, EEC, OECD);

(b) Major bilateral donors;

(c) Voluntary, support and community organizations in the developed world.

89. The United Nations Advisory Committee on IYA will take key decisions to establish the basic organizational machinery for IYA and lay down policy guidelines for activities. It will designate the lead and support agencies; the International Trust Fund; and make recommendations on extrabudgetary support. It will evaluate the operations of IYA.

90. The International Trust Fund will act as a repository for international voluntary contributions towards the core support work of the IYA international secretariat and support agency, and will monitor and report on disbursements to the Advisory Committee.

91. International voluntary organizations many of which already play a leading role in development work in Africa, should be involved from the beginning in financing, support and implementation of IYA activities. Together with other voluntary organizations, they should have representation on the International Trust Fund.

92. The United Nations System: Organizations and units of the United Nations system should be individually and collectively requested to co-operate with the designated lead agency in:

(a) Reviewing ODA policy towards Africa;

(b) Examining existing policies, programmes and projects in the area of food and agricultural production in Africa;

(c) Participating in joint programming exercises for the development of research, training and the dissemination of information relating to IYA;

(d) Promoting technical co-operation between developing countries at various levels in supporting the programme of activities for IYA;

(e) Reviewing progress on IYA periodically at inter-agency meetings.

93. The designated lead agency will serve as the intergovernmental body responsible for the co-ordination of activities to be undertaken before the commencement of the International Year. In particular, the lead agency should:

(a) Establish and supervise the operations of the international secretariat;

(b) Identify ways and means of obtaining financial and other support for the activities envisaged;

(c) The lead agency, in close collaboration with the national department of state should establish the instruments for managing and controlling the funds - national and international;

(d) Co-ordinate the activities of sister agencies;

(e) Monitor the state of implementation of the programme of activities on the basis of reports from participating bodies. This should include the issue of periodic reports, and final report which would cover the strategy for Africa agriculture over the long-term; and

(f) Provide support through the regional offices for activities during the celebration of IYA.

94. The support agency should be a regional organization closely concerned with day-to-day operations within Africa. Its main function will be to co-ordinate with the lead agency in the preparation and implementation of the programme of activities, and to provide operational support at the subregional level.

95. The international secretariat will prepare and disseminate information on IYA, including fact-sheets, programme suggestions and press briefing. It will act as a supporting agency for the national co-ordination and international voluntary groups.

VI. CONCLUSION: THE INTERNATIONAL YEAR TO END HUNGER AND POVERTY IN AFRICA

96. The major concern of this document is to propose an International Year to End Hunger and Poverty in Africa through mobilization of financial and technological resources to increase food and agriculture production. This proposal notes that although Africa has immense agricultural potential, it has gradually lost its capacity to feed its growing population. This inability stems from neglect of agriculture and the cummulative inadequacies of policies and institutions over the past two decades. The extractive, urban-biased policies of many African States in post-colonial era have denied agriculture its priority as the motive force for development. The interplay between this misunderstood role of agriculture and other deep-seated predisposing factors - political, social, technical, economic - coupled with natural disasters - have compounded the situation, spawing the present agrarian crisis with concomitant devastating famine, poverty and a deepening food import dependency.

97. One critical cause of this chronic agrarian crisis is the existing technology gap in the African food and agriculture sector. While African governments have retained past emphasis on agricultural research - mostly on export crops, - there is acute underinvestment in basic and adaptive research and technology suited to essential staple food crop and livestock production. Agricultural development has been titled more towards the politically powerful resource-rich farmers high potential regions, than to small poorer farmers and particularly women and depressed to ess

98. In elaborating the proposal, the document advocates for the sustainability of food and agricultural production systems aimed at achieving African agricultural revival, and that will avert possible economic and political disasters on the continent. This calls for a critical review, a rethinking and a reorientation of policies and strategies involving depackaging of African and other experiences. Thus, rather than become preoccupied mostly with the transfer of alien technologies, as is now the case, the challenge lies in a massive and complex task of reorientation, greatly strengthening Africa's agricultural research and production systems and the development of new technologies.

99. It is noted that it will be difficult and costly to bring about this postulated transition in African agricultural recovery for sustained growth and development. However, since the long-term pay-offs far outweigh the cost of waiting or inaction and of potential economic and political catastrophies, this is the time to begin.

100. Therefore, the inescapable conclusion is that African agriculture requires substantially greater financial and technological development support than hitherto from domestic and external sources if this sector is to make the urgent sustained recovery from the present crisis. It is these considerations that underlie the proposals in this document for launching a series of practical remedial measures and plans by all concerned, as part of the International Year to End Hunger and Poverty in Africa.

101. This will require a redefinition and realignment of policies, structures and institutions so as to create the necessary framework for a sustained self-reliant development of the sector. This must be supported by an unflinching political will.

Footnotes

1/ World Bank, Toward Sustained Development in Sub-Saharan Africa: A Joint Programme of Action, 1984.

2/ FAO/UNFPA/IIASA, "Land and Population", paper presented to the twenty-second session of the FAO Conference, Rome, November, 1983.

3/ FAO, The state of food and agriculture 1986; CL 90/2 - sup. 1, November 1986, p.7, para. 30.

4/ Donors meeting on rehabilitation of agriculture in Africa, Rome, 29 March 1985.

5/ DES: Dietary energy supply.

6/ ECA, Situation of food and agriculture in Africa, Addis Ababa, 14 February 1984, table 5, p.10.

7/ ECA, Africa's food and agriculture crisis: prospectives and proposals for 1985 and 1986, 1 April 1985, p.2.

8/ Adopted by the African Heads of State and Government in July 1985.

9/ Adopted by the thirteenth special session of the United Nations General Assembly held in May 1986.

10/ UNDP/FAO National agricultural research, FAO, Rome 1984, p.6.

11/ OAU/ECA, Africa's submission to the special session of the United Nations General Assembly on Africa's economic and social crisis, Addis Ababa, March 1986, pp.63 and 64.

12/ Ibid., pp.63 and 64.

13/ OECD, Twenty-five years of development co-operation: A review. Paris, 1985, p.214.

14/ UNDP/FAO, National agricultural research; Report of an evaluation study in selected countries, Rome, Italy, 1984.

15/ Ibid, p.65, para.8.2.

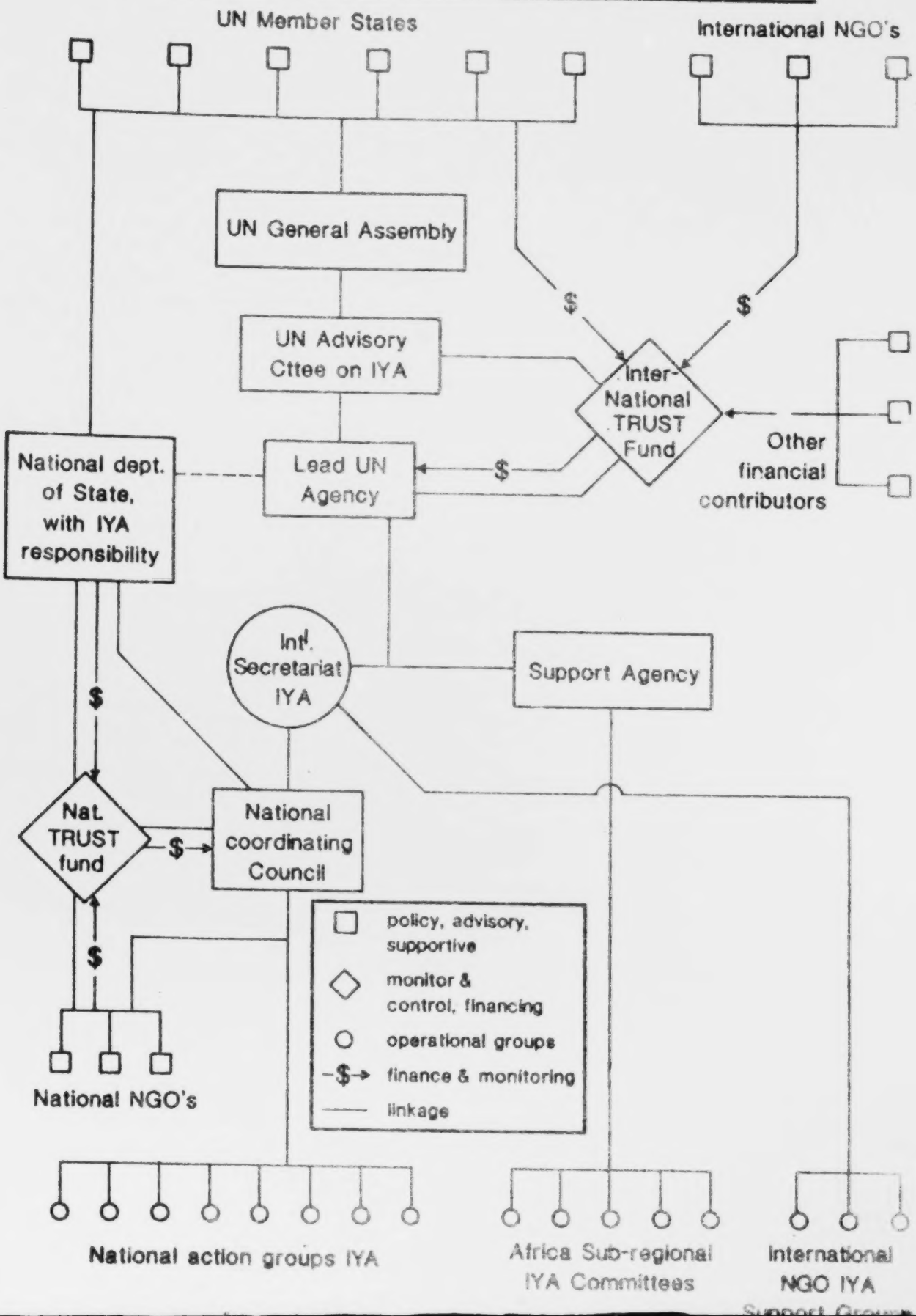
16/ A rate of investment in research of at least 1 per cent of agricultural GDP as also suggested in the UNDP/FAO study and by a SPAAR Working Group* would call for an annual investment of $US 0.7 billion. This estimate is however, considered low as it would result in a shortage of technology (UNDP/FAO, p.65, para. 8.1).

* Guidelines for strengthening national agricultural research systems in sub-Saharan Africa, draft, October 1986, p.11.

17/ For agriculture, the ratio of external resource requirements to total cost in APPER is 0.2985:1. The same ratio is applied in the financing of research.

18/ UNGA, United Nations Programme of Action for African Economic Recovery and Development.

ORGANISATIONAL CHART FOR INTERNATIONAL YEAR 1991



Annex II

Financial requirements for the International Year of Shelter for the Homeless

(All amounts in thousands of US dollars at 1983 rates)

I. Operational programme for the year

	RB a/	XB b/	RB	XB	RB	XB	RB	XB	RB	XB	RB	XB	RB and XB
Regional and experts meetings	-	-	-	205.8	-	102.8	-	226.7	-	-	-	735.1	535.1
Support activities of non-governmental organizations	-	27.5	-	27.5	-	27.5	-	27.5	-	27.5	-	137.5	137.5
Demonstration projects													
(a) Planning and co-ordination	-	126.5	-	193.5	-	183.7	-	174.7	-	166.7	-	845.2	845.2
(b) Direct technical advice assistance	-	231.0	-	432.7	-	444.8	-	258.9	-	71.0	-	1 438.2	1 438.2
Subtotal I	-	385.1	-	859.3	-	758.8	-	685.8	-	265.2	-	2 954.0	2 954.0
Temporary staff	-	44.8	144.8	85.7	144.8	85.7	144.8	85.7	144.8	85.7	578.4	387.8	966.0
Audio-visual training and programme support information	-	42.4	25.0	80.0	-	134.9	-	112.8	25.0	183.7	50.0	534.1	584.1
Travel	-	31.0	-	31.0	-	31.0	-	31.0	-	44.9	-	168.9	168.9
Communications	-	44.0	-	44.0	-	44.0	-	44.0	-	44.0	-	220.0	220.0
Interagency working group meeting	- -		17.1	-	-	-	17.1	-	-	-	34.2	-	34.2
Subtotal II	-	162.2	186.7	221.2	144.8	295.8	161.7	273.3	169.8	358.3	662.6	1 310.8	1 973.2
Grand total	-	547.3	186.7	1 080.5	144.8	1 054.2	161.7	959.1	169.8	623.5	662.6	4 264.8	4 927.2

Source: International Year of Shelter for the Homeless: Report of the Secretary-General (Addendum)

a/ RB = regular budget.

b/ XB = extrabudgetary.

UNITED NATIONS
ECONOMIC AND SOCIAL COUNCIL

Distr.: GENERAL
E/ECA/CM.13/10/Summary
6 February 1987
Original: ENGLISH

ECONOMIC COMMISSION FOR AFRICA

Eighth meeting of the Technical Preparatory Committee of the Whole

Addis Ababa, Ethiopia
13 - 20 April 1987

Item 6 of the provisional agenda*

ECONOMIC COMMISSION FOR AFRICA

Twenty-second session of the Commission/ thirteenth meeting of the Conference of Ministers

Addis Ababa, Ethiopia
23 - 27 April 1987

Item 5 of the provisional agenda**

LG/NAIP021

INTERNATIONAL YEAR FOR THE MOBILIZATION OF FINANCIAL AND TECHNOLOGICAL RESOURCES TO INCREASE FOOD AND AGRICULTURE PRODUCTION IN AFRICA

Executive Summary

* E/ECA/TPCW.8/1.
** E/ECA/CM.13/1.

M87-304

1. The major concern of this document is to make proposals in respect of an international year devoted to the mobilization of financial and technological resources for food and agriculture in Africa which might be designated in 1991 in accordance with United Nations General Assembly resolution 38/198 of 20 December 1983.

2. These proposals, which fundamentally reflect Africa's Priority Programme for Economic Recovery (APPER) and the outcome of the special session of the United Nations General Assembly on the African economic crisis, note that though Africa has immense agricultural potential, it has gradually lost its capacity to feed its growing population. This inability stems from neglect of African agriculture and the commulative inadequacies of policies and institutions over the past two decades. The extractive, urban-biased policies of many African States in the post-colonial era have denied agriculture its priority as the motive force for development. The interplay between this misunderstood role of agriculture and other deep-seated predisposing factors - political, social, technical, economic - coupled with natural disasters, have compounded the situation, spawning the present agrarian crisis with concomitant devastating famine, poverty and a deepening food import dependency.

3. One critical cause of this chronic agrarian crisis is the existing technology gap in the African food and agriculture sector. While African Governments have retained past emphasis on agricultural research - mostly on export crops, - there is acute underinvestment in basic and adaptive research and technology suited to essential staple food crop and livestock production. Agricultural development has been tilted more towards the politically powerful resource-rich farmers and high potential regions, than to small poorer farmers - and particularly women and depressed areas.

4. In elaborating the proposals, the document advocates for the sustainability of food and agricultural production systems aimed at achieving African agricultural revival, and which will avert possible economic and political disasters on the continent. This calls for a critical review - a rethinking and a reorientation of policies and strategies - involving depackaging of African and other experiences. Thus, rather than become preoccupied mostly with the transfer of alien technologies, as now pertains, the challenge lies in a massive and complex task of reorientation, greatly strengthening Africa's agricultural research and production systems - and, above all, the development of new and unexplored technologies.

5. It is noted that it will be difficult and costly to bring about this postulated transition in African agricultural recovery for sustained growth and development. However, since the long-term pay-offs far outweigh the cost of waiting or inaction and of potential economic and political catastrophies, this is the time to begin.

6. Therefore, the inescapable conclusion is that African agriculture requires substantially greater financial and technological development support than hitherto from domestic and external sources if this sector is to make the urgent sustained recovery from the present crisis. In fact, the food and agricultural

UNITED NATIONS
ECONOMIC AND SOCIAL COUNCIL

Distr.: GENERAL
E/ECA/CM.13/11
24 February 1987
Original: ENGLISH

ECONOMIC COMMISSION FOR AFRICA

Eighth meeting of the Technical Preparatory Committee of the Whole

Addis Ababa, Ethiopia
13 - 20 April 1987

Item 6 of the provisional agenda*

ECONOMIC COMMISSION FOR AFRICA

Twenty-second session of the Commission/ thirteenth meeting of the Conference of Ministers

Addis Ababa, Ethiopia
23 - 27 April 1987

Item 5 of the provisional agenda**

LG/NAIROBI.

REPORT ON MEASURES TAKEN BY AFRICAN COUNTRIES TO REDUCE POST-HARVEST FOOD LOSSES OVER THE PERIOD 1975-1985

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* E/ECA/TPCW.8/1.

** E/ECA/CM.13/1.

87-

FOREWORD

In consonance with resolution 3362 (S-VII) adopted in 1975 by the seventh special session of the United Nations General Assembly, which called for a 50 per cent reduction of post-harvest food losses in developing countries by 1985, and with the specific recommendations on the development of the food and agricultural sector contained in the Lagos Plan of Action for the economic development of Africa, the Economic Commission for Africa (UNECA) incorporated in its biennial work programmes a number of activities aiming at sensitizing member Governments on the importance of reducing post-harvest food losses in the overall strategy for food self-sufficiency and at assisting member countries in their efforts to tackle the problem.

This report is an output of the programme element related to activities on reduction of post-harvest food losses contained in the approved work programme and budget of the Commission for the biennium 1986-1987. Its main objective is to report to the eighth meeting of the Technical Preparatory Committee of the Whole, to the thirteenth meeting of the Conference of Ministers and to the General Assembly on measures taken by African member States to reduce post-harvest food losses over the period 1975-1985.

Following the introduction which gives the background of growing concern about the issue, the paper provides:

(a) An overview of the main causes of post-harvest food losses and their present importance in Africa;

(b) The salient features of measures taken by member States and supportive international organizations and development agencies; and

(c) Some proposals for a future strategy to further reduce post-harvest food losses in Africa.

INTRODUCTION

1. Early in the 1970s, the marked decline of the per caput availability of locally produced food in the developing world and more particularly in Africa became alarming. In Africa this decrease has been significant and the per caput cereals availability decreased from 166 kg in the early 1950s to 154 kg in the 1970s. The spectre of recurrent famines became preoccupying as projected and aggregate agricultural output for the next decade did not cope with that of the growing population. Against this background, most of the proposed and adopted strategies aimed at boosting agricultural production and little attention was paid to saving a good part of what have been harvested. While considerable amounts of food were lost by pests, diseases, rodents and waste at a time when millions of people were either starving or suffering from malnutrition. Even when it became notorious that reducing the losses of produced food in developing countries would have to play an important part in the overall effort for increasing food availability, activities towards preventing post-harvest food losses were limited to a few initiatives of some development agencies without an effective involvement of developing countries themselves and by no means that of subsistence farmers.

2. It is really in 1974 that the importance of the post-harvest aspects of cereal-grains losses in developing countries were highlighted by the Food and Agriculture Organization of the United Nations (FAO) at the World Food Conference held in Rome. It revealed that post-harvest food losses of cereal-grains can reach as high as 30 per cent in the hot moist air of the tropics and around 10 per cent in the arid zones; for more perishable crops, the figures could be as high as 40 per cent. For fishery products, some estimates placed losses among the highest for all commodities, reaching as high as 50 per cent. The perishability of meat and dairy products were also estimated to be very high. Although estimates of post-harvest losses were at that time based on subjective judgements and scant observations, the magnitude of the problem provided necessary incitement to sensitize and stimulate countries and the international community to give the right consideration to the problem of post-harvest food losses.

3. Responding to this long-standing need, the issue received some prominence at the seventh special session of the United Nations General Assembly in 1975, whose resolution 3362 (S-VII) on the development and international economic co-operation included in the operative paragraph on food and agriculture, the following:

> "The further reduction of post-harvest food losses in developing countries should be undertaken as a matter of priority, with a view to reaching a 50 per cent reduction by 1985. All countries and competent international organizations should co-operate financially and technically in the effort to achieve this objective particularly in the systems of distribution of foodstuffs".

4. In Africa where the food and agricultural sector has drastically deteriorated over the years since the 1960s, and where severe food shortages brought about unprecedented famines and increased dependence on food imports, the problem of food availability and food security has been more than preoccupying. Because of the recurrent drought and the low capacity of investment in the agricultural sector, most of the member countries and more particularly those in sub-Saharan Africa have not been able over the last two decades to boost production like in other developing regions. Therefore, securing a substantial reduction in food losses and wastage have been seen as an important component of food security strategies. On the basis of these considerations, the Lagos Plan of Action

for the economic development of Africa (1980-2000), adopted by African Heads of State and Government, fully endorsed the recommendation included in the United Nations General Assembly resolution 3362 (S-VII) and urged that actions towards reducing food losses must include the following:

(a) Careful assessment of the extent of food losses;

(b) Formulation of national policies for food loss reduction;

(c) Mass-media campaigns to educate the public on methods of reducing food waste;

(d) Construction of appropriate storage, processing and other facilities;

(e) Establishment of central technical units;

(f) Promotion (through research, infrastructural development and incentives to farmers and fishermen) of improved methods of drying, preservation, storage, pest control and processing;

(g) Improvement of livestock routes and holding grounds; and

(h) Training of technical staff for food loss control, preferably through subregional/regional institutions, seminars and workshops.

5. Ten years after the adoption of resolution 3362 (S-VII) by the United Nations General Assembly calling for the reduction of food losses by half over the period and five years following the recommendations for specific measures towards attaining the same goal made by the African Heads of State and Government, the problem of food losses in general and of post-harvest food losses in particular remains a real problem for Africa in the context of the present crisis, characterized by acute food shortages and food insecurity. During the past 10 years, a lot of valuable activities aiming at assessing the extent of reduction of food losses have been undertaken by member States with the assistance of development agencies and international organizations. However, the question on whether such activities have contributed to the attainment of the goal of halving the magnitude of food losses or reducing it by a given percentage is rather difficult to respond to at this stage.

I. AN OVERVIEW OF THE POST-HARVEST FOOD LOSSES IN AFRICA

6. In 1976, the Food and Agriculture Organization (FAO) estimated losses of cereals and legumes grains in developing countries to be at least some 42 million tons. Based on projections of food crop production and on the assumption of continued losses at the same relative level, the Organization estimated that the minimum post-harvest food losses would be about 110 million tons in 1985. Although latest data on this issue is not available, the indications are that the trend and magnitude of loss are substantial. For the African region, post-harvest food losses were estimated at about 7 million tons for cereals alone in 1977. At the 1975 prices, such loss was worth $US 930 million or equivalent to 45 per cent of the actual total cereal imports of the region in 1984.

7. The above figures are illustrative and show the magnitude of the problem. However, this global estimation does not reflect the prevailing situation in a given country as post-harvest food losses are commodity- and location-specific. The nature and magnitude of losses vary greatly with the nature of the commodity (whether it is durable or perishable), the climate (degree of humidity and temperature), the high incidence of pests or combination of pests (insects, mites, micro-organisms and rodents) and the socio-economic setting. Also, the post-harvest losses which occur at each stage will differ from one commodity to another.

8. In Africa, durable crops include cereal grains such as maize, sorghum, millet, wheat and rice and legume grains like dwarf beans, cowpeas, pigeon peas and groundnuts; perishable crops include roots and tubers (mainly yam, cassava, sweet potato and potato), fruits and vegetables. Besides these main crops, the perishability of meat, dairy and fishery products is even higher. While meat and dairy products are usually consumed fresh in Africa, and more particularly in rural areas where ice plants and freezers do not exist, an important part of fishery products is cured (dried, salted or smoked) and stored for a long period. Only the case of such processed products for which storage problems are similar to cereal or legume grains will be dealt with.

9. For a given commodity, the climate is an important factor of deterioration or of safe keeping. High temperature and humidity are favourable to mold formation and rapid growth of insects. It has been observed that losses in the savannah zone are fewer than in the hot and humid forest zone. Also for a given commodity, the number of post-harvest operations and the nature of technology used will bring about more or less loss. Since these operations are different from one category of commodity to another, it will be practical to consider the problems separately.

A. Post-harvest losses in cereal and legume grains

10. After food grains are harvested, they are manipulated through a sequence of operations including threshing (shelling in the case of maize and decorticating for legume grains), drying, cleaning, parboiling in the case of rice, transportation, storage and processing before the end-product is suitable for consumption. Preliminary operations for obtaining clean grains are usually called primary processing while milling, baking, brewing, are processing operations. Each stage of the sequence will induce losses where magnitude will depend on grain nature (especially the structure of the kernel) and/or the appropriateness of the technology used.

1. Losses during primary processing

11. At this stage, the loss is quantitative and its magnitude is a function of the size of the grain and its structure. Table 1 gives some implications of these operations associated with the structure of the kernel. Traditional primary processing methods usually bring about breakage, germ damage and wastage. For these operations, the stage of harvesting is a critical factor as high moisture content of grain will increase losses and impair some functional properties, particularly during the drying period.

2. Losses during storage

12. The importance of storage in the post-harvest system is justified by the fact that in subsistence farming, farmers need to store the harvested products for a period separating two harvests. In areas of multiple cropping, the storage time will be limited from three to six months but in cases of single cropping, this period can be extended to 12 months. The degree of damage of stored products is likely to increase with the length of the storage. Also, for a given commodity of food crops, one variety will be more resistant than another to a certain range of pests and will be more adapted to certain modes of storage. In most cases, local varieties have proven to be more resistant to insects infestation and more adopted to traditional modes of storage. Given the nature of grain, the structure of the storage facilities will determine the type and extent of losses caused by biological factors. The main biological agents of deterioration of stored grains, both in weight loss and in quality loss, are insects, mites, fungi and rodents. The main rodents causing important losses are:

(a) Rathus norvegicus, the common brown rat;

(b) Rattus ratus, the black rat; and

(c) Mus musculus, the house mouse.

13. With regard more particularly to insect pests attacking stored products, the range of pests generating great losses includes: the grain weevil (Sitophilus), the flour beetle (Tribolum), the lesser grain borer (Rhizoperta), etc. A list of common insect pests in stores of the tropics is given in annex I. The specific cases of Trogoderma granarium (E) (beetle) and Prostephanus truncatus (Horn) (grainborer) deserve a special consideration because of the importance of damage they have caused and continue to cause and their rapid spread in Africa. Trogoderma granarium is a coleoptera which thrives in arid zones and where its natural predators (bacteria and fungi) hardly grow. This pest is a real danger for stored millet, sorghum, maize, rice, wheat, cowpea and groundnut. As this pest infests mainly threshed, shelled or decorticated grains, the damage it can cause in on-farm stores is limited. But in the Sahelian countries where the climate is optimum for the expansion of this pest and where chronic food deficit imposes to countries' importation and storage of huge quantities of grains, the danger is very great. According to L.A.W. Hayward 1/, 30 per cent of millet procured by the Office des produits vivriers in the Niger (OPVN) and estimated to be about 80,000 metric tons per year, are deteriorated by T. Granarium. This loss amounts to about 24,000 tons or $US 6 million in value at 1970 prices. He also reported that in Senegal out of 400,000 tons of rice imported in 1982, about 6,000 tons were destroyed by T. Granarium, corresponding to a value of $US 1.5 million. Prostephanus truncatus (Horn) is a coleoptera widely spread in Central America where it is known to destroy, but to a lesser degree, stored unshelled maize and other cereal grains. This insect pest was identified in Africa for the first time in 1980 in the Tabora region of the United Republic of Tanzania. Between 1981 and 1984, the pest

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1/ The control of infestation of stored products by Trogoderma granarium and Prostephanus truncatus. In proceedings of an International Seminar held in Lome, Togo, from 10 to 15 December 1984. Published by the "Deutsche Geselschaft fin Technische Zusammenarbeit (GTZ)".

Table 1. Some implications of kernel structure

Signficiance in	Parameter	Effect	Commodity
Threshing	Germ damage or skinning	Reducing germinability, impaired storability	All cereal grains
Drying	Cracks, fissures and breakage; hardening	Reduced commercial value; lowered grade, impaired storability, dust formation, reduced starch yield	Mainly corn and rice
	Discolouration	Reduced commercial value; lowered grade	Mainly rice
Marketing	Breakage	Reduced commercial value in food processing	Mainly corn and rice
General use	High husk: caryopsis ratio or high pericarp: endosperm ratio	Reduced nutritional value as food or feed	All cereal grains
General use	Kernel shape and dimensions; proportions of tissues in the kernel, distribution of nutrients in the tissues	Yield of food products; nutritional value of cereal (or cereal products) as food or feed	All cereal grains
Malting	Germ damage, skinning, or inadequate husk adherence	Reduced germinability, uneven malting	Mainly barley and sorghum
Milling	Uneven surface, deep crease or uneven aleurone	Reduced milling yield	Mainly wheat and rice
Milling	Steely texture	Increased power requirements, starch damage, high water absorption, difficulty in air classification	Wheat and malt milling
Germinating-malting	Starch granule size	Uneven degradation	All cereal grains
Consumption-nutrition	Distribution and position of protein	Change in nutritional value	All cereal grains

Source: Post-harvest losses in quality of food grains. FAO, Food and nutrition paper 29, 1983.

has contaminated other maize-growing regions in the United Republic of Tanzania, in Burundi and Kenya. In 1984, Prostephanus truncatus was identified for the first time in West Africa, in Togo. Contrary to T. granarium, P. truncatus usually attacks unshelled maize cobs. Most of the damage it causes is therefore observed in on-farm stores and particularly in areas with high maize-growing potential. Also, this pest which was not virulent in Central America has been found a dangerous storage pest in Africa. A study conducted by the Tropical Development and Research Institute (TDRI) in 1980 estimated the magnitude of losses caused by P. Truncatus on maize in the United Republic of Tanzania to about 9 per cent. The study further estimated that the financial loss for this country would be about $US 27 million yearly if it happens that the pest is widespread to all maize-growing regions. The above-mentioned elements are self-explanatory on the danger of Trogoderma granarium and Prostephanus truncatus. The first pest inflicts great losses to stored grains in the chronic food-deficit countries of the continent and the second is a real threat in the promising maize-growing regions.

3. Losses during grain processing

14. Generally speaking, hard cereal grains such as millet, sorghum, maize and some legume grains are not available to consumers in a convenient ready-to-use form. Grains should be ground or milled into flour, then processed into some forms of food which can be kept safely. The usual traditional methods of pounding or grinding grains in Africa are not only laborious and time-consuming but also induce losses. Effectively, in repeatedly pounding, moisturing, sifting and winnowing the grains, the rural housewife will need 4.5 kg of whole grains to produce 3 kg of flour, bringing the rate of loss to 30 per cent during this process. Also, prior moisturing of grain before milling results in flour still containing about 30 per cent water and which turns rancid if not used within two days. Storing such flour without good drying opens way for microbial and fungal attack. In the case of rice, milling brings about breakage of a large part of the produce. Also, a recent study undertaken by the Tropical Produce Institute (TPI) has shown that as much as 50 per cent of small broken rice grains can be lost in the cooking water. Another source of important loss through grain processing is the alcoholic fermentation for producing beverage; the process simply halves the caloric value of the whole grain. The total post-harvest loss in cereal and legume grains will be the sums of all weight quality and energy losses occurring during all the stages of the process from the harvest to the final food ready for consumption. The part of losses occurred at each stage is hardly assessable except in few cases of pilot but limited studies. Table 2 gives estimates of total post-harvest losses or at various stages of the post-harvest system in some cereal and legume grains in selected African countries where such assessment was undertaken.

B. Post-harvest losses in roots and tubers

15. Although post-harvest losses in roots and tubers have not been widely assessed, their magitude is likely to be high due to the high water content of these commodities. Losses occur mainly during transportation, storage and processing but harvesting remains an important factor since if it is carried out bruising or otherwise damaging the produce, nothing much can be done to further improve the handling. Following the harvest, yam, cassava and potato lose weight through rapid dessication. The maximum length of possible storage of fresh produce varies from less than a week for cassava, to three months for potato and six months for yam. In the case of potato and yam, the traditional

Table 2. Order of magnitude of post-harvest food losses in cereal and legume grains in selected African countries in the 1980s

Countries	Percentage of losses				
	Harvest	Transport and handling	Storage	Processing	Global figur
		1. For cereal grains			
Botswana					20
Burkina Faso	2-10	2-7	4-5	8-10	
Burundi	2-5	-	15	1-2	
Cameroon	-	-	6	-	
Chad	5-20	5-15	10-40	-	
Libyan Arab Jamahiriya	5-10	-	10-20	-	
Mali					7
Morocco	5-10	0-2	5-10	0-2	
Mozambique	15-25	2-10	2-10	6-8	
Rwanda	-				20
Sudan	-	-	10	-	
Tunisia	1-3	2-3	4-6	-	
		2. For legume grains			
Burkina Faso	6	2	8	-	
Burundi	1	-	10	-	
Morocco			5		
Mozambique	3-6	2-5	7-15	-	

Source: Computed from fragmentary loss estimates made during various projects.

- : Information not available.

barn or other shelters do not prevent high losses caused by nematodes (mainly Scutellanema) fungi and bacteria, rodents and insects. During storage also, sprouting and respiration account for weight loss.

16. With regard to processing roots and tubers, it is usually cassava which traditionally is processed; yam is processed to a lesser extent into flour and the processing of potato is not that much developed in Africa. Cassava, particularly the bitter variety, is processed and dried. The process not only provides long-lasting products but reduces the toxicity due to the presence of Cyanogenic glycosides. Cassava flour or granules (gari) can be stored without serious damage if moisture content is about 12 to 13 per cent. However, like stored cereal and legume grains, produce can still be infested by insect and fungi. Peeled and dried cassava stored in the form of dried cossettes are also severely attacked by Prostephanus truncatus in areas already infested by this pest. Table 3 gives the estimates of losses in roots and tubers in some African countries where pilot assessments were undertaken.

Table 3. Estimated roots and tubers total losses in selected African countries

Countries	Estimated losses (in percentage)
Benin	35-50
Cameroon	35
Côte d'Ivoire	35-40
Ghana	15-30
Madagascar	5-10
Nigeria	15
Rwanda	35-55
Zaire	10-25

Source: Extracted from the "Report of the workshop on production marketing constraints on roots, tubers and plantations in Africa" vol. II, FAO, 1985.

C. Post-harvest losses in fruits and vegetables

17. Because of their high moisture content (50 per cent and over), fruits and vegetables are the most perishable after harvest under humid and hot environment, losses are clearly excessive. Crude harvesting tools like pickling poles will bring about blemish and injury at the harvest time, aggravating handling problems. Furthermore, unsuitable packaging materials such as large sacks, rough wooden boxes, bamboo baskets are contributing to bruising, crushing and puncturing produce, thereby contributing to rapid rotting. Traditionally, a few vegetables like okra, local vegetable leaves, pepper, etc., are dried for conservation. In most cases, storage of fruits and vegetables is a crucial standing problem due to the lack of processing technologies and the fact that the introduction

of cool stores is for the time being uneconomic. From a recent study 2/ undertaken in Togo, the magnitude of total losses of fruits ranges from 15 to 42 per cent for mangoes, 10 to 15 per cent for pineapples and 5 to 8 per cent for citrus. For vegetables, the estimated losses during the study were at the harvest stage only, 7 to 12 per cent for tomatoes and 2 to 3 per cent for okra. These figures could be representative of the situation in most African countries where the marketing of fruits and vegetables is not organized and where cool stores and processing facilities are lacking.

D. Post-harvest losses in cured fishery products

18. Traditional methods of processing fish include sun-drying, salting and smoking. The efficiency of these operations is directly affected by the species of fish (fatty fish may pose some problems), the expeditiousness of completing the operation before the fish is already putrid and the failure to remove the gall bladder. Losses incurred can be both of nutritional and quantitative nature. Their magnitude is related to the efficiency of the processing method and the environment in which the fish is processed and then stored. The nutrients loss is mainly related to protein damage induced by hot smoking. Quantity loss is related to infestation by fly larvae, moulds bacteria and insects (especially Dermestes Spp). Fragmentation during inadequate handling and transportation can also bring about serious weight loss. There are few precise data on the magnitude of losses in cured-fish but FAO reported that in Senegal, losses of unsalted fish could vary between 10 to 30 per cent during processing and distribution; that in Burkina Faso, 25 per cent losses due to Dermestes Spp. are typical and that weight losses due to fragmentation varies from 25 to 56 per cent, depending on the fish species, during transportation from Lake Chad to southern Nigeria.

E. Post-harvest food losses in livestock products

19. In Africa, most of the meat is consumed fresh and only a small portion is processed (sun-dried and spiced meat in arid zones; production of ham, bacon, sausages and other products mainly in countries of Eastern and Southern Africa). With the exception of sun-dried meat, fresh and other processed products are stored using refrigeration. In this case, losses incurred are likely to be minor. However, the use of refrigeration to preserve meat and processed products are still limited to urban slaughter houses. Seizure of infested meat or meat not proper for human consumption in slaughter houses is also part of post-harvest losses in livestock products. It is rather unfortunate that, due to the fact that the problem has not been surveyed, estimates of magnitude of post-harvest losses in livestock products hardly exist.

2/ Etude sur la production et la commercialisation de fruits et légumes au Togo : Rôle de la femme, CEA, 1985.

II. MAJOR EFFORTS IN REDUCING POST-HARVEST FOOD LOSSES

20. Attempts to preserve harvested food commodities had begun earlier than 1975 in most of African countries through the use of traditional methods of protecting stored products and processing fresh food. Although the causes of losses were more or less perceived, neither their magnitude nor the economic implications were assessed. Moreover, the problem was not tackled in a global post-harvest system but rather in a fragmented manner. The resolution of the United Nations General Assembly has not only stimulated the interest of African Governments but also contributed to bringing many agencies/organizations to joining efforts and resources for achieving quick results. Measures taken in reducing post-harvest food losses included the elaboration of loss assessment methods, the improvement of storage conditions, the improvement of handling and processing of food commodities and the training or education of personnel (including the farmers) involved in such activities.

A. Institutional framework of efforts

21. The importance of activities undertaken by member States towards reducing post-harvest food losses during the period between 1975 and 1985 varies from one country to another, depending on the priority accorded to the problems, the availability of resources, the efficiency of Government established institutions for the purpose and the socio-economic environment of the country. Also, efforts made by African member countries in reducing food losses have been significantly supported by many development agencies, international organizations and non-governmental organizations. Therefore, dealing with achievements so far made will necessitate giving the role of all parties involved.

1. Role of member countries

22. From information gathered from field missions and various available reports, it would seem that in most countries, the importance of food-saving measures has been given right consideration and sensitization campaigns were mounted through the mass-media, particularly through radio broadcasting. Also, during several fora, officials from member States reiterated their commitment to adopting practical measures for reducing food losses and waste as complementary actions in attaining food self-sufficiency. Practically all member countries have established plant protection services, while extension workers, in the limit of their means, have made valuable attempts to provide advice to farmers regarding simple methods of improving the existing post-production practices, to design and promote appropriate small-scale storage structures for farmers, and co-operatives or cereal banks. The national extension services particularly have popularized adapted traditional methods of pestcontrol such as rat guards, use of local herbs and ash to prevent grain stocks from infestation.

23. Besides the national plant protection services whose tasks have been more oriented to pre-harvest operations and less to post-harvest operations, the grain marketing boards have played a major role in associating activities for improvement of post-harvest operations with produce procurement, transportation and storage. Through the boards, Governments invested quite a lot in constructing central stores which are adapted to the prevailing environment and to the efficient use of contact chemicals and fumigants for pest control. The construction of large-scale structures has been associated with the training

of qualified teams for an efficient management of the stores. In addition to improving large-scale storage facilities, the boards, in some cases, promoted adequate drying and quality-control of produce. National programmes towards preserving harvested food also included the development of food processing facilities. It is noteworthy that in most countries, small-scale grain mills have been widely established in rural areas and such mills have been improved over the years so that multi-purpose mills are now available. Also, large-scale mills have been promoted, as well as bakeries, fruit canning plants, etc. The efforts of member countries to develop food preservation industries are noteworthy and during the West African Industrial Forum held in Dakar in 1985, 50 out of 100 projects established were related to food processing.

24. The national programmes in reducing post-harvest food losses were also supported in many cases by national research and technology development institutes. Some institutes made quite valuable achievements in manufacturing post-harvest tools including threshers, winnowers, maize-shellers and other concentrated efforts in food technologies. A list of such national institutes is given in annex II. An important component of measures taken by member States to reduce post-harvest food losses is the establishment, in some cases, of national co-ordinating units charged with the co-ordination of inter-departmental and inter-institutional activities.

2. Role of African subregional and regional organizations

25. Besides the national programmes, some African subregional and regional organizations promoted, directly or indirectly, activities aiming at preserving food and reducing post-harvest food losses. In West Africa, the Permanent Inter-State Committee for Drought Control in the Sahel (CILSS) have carried out several storage improvement activities as part of the regional food security programme in the Sahel. The Central African member States have established in Yaounde, Cameroon, a Regional Centre for Training in Plant Protection. In Eastern and Southern Africa, the newly established Association of Food Marketing Agencies (AFMESA) instructed its members to co-operate in tackling the problem of post-harvest food losses. Also, the Southern African Development Co-ordination Conference (SADCC) established the Post Production Food Industry Advisory Unit (PFIAU) as one of the operative arms of its food security programme, of which the objective is to "critically assess the post-production food systems in each member State and to initiate programmes to ensure that sufficient food is more readily available through loss and waste reduction (especially in storage) in a cost-efficient manner; to critically evaluate the food processing and loss prevention systems and to introduce innovations and improvements to existing technologies that will improve the achievement of food security in a cost-effective manner". In North Africa, the Arab Organization for Agricultural Development (AOAD) and the Centre d'étude industrielle maghrebin have undertaken several activities aiming at improving food storage conditions. Also, the Regional Marketing Project for the Near East was involved in activities aiming at reducing post-harvest food losses in some North African countries.

26. At the regional level, the Organization of African Unity (OAU) has established the Inter-African Phytosanitary Advisory Council which has promoted activities related to eradicating major crop-pests. The Council, inter alia, mobilized member countries and development agencies for an exchange of information on how to combat Trogoderma granarium. At the regional level too,

the Comite interafricain de technologies post-recolte (CITPR), which is composed of African researchers, initiated the development of a regional network for the improvement of post-harvest operations.

3. Role of the United Nations system

27. Following the resolution of the General Assembly, several United Nations agencies/organizations included in their regular work programmes activities oriented to reduce post-harvest food losses. ECA, which, inter alia, played a major role in the formulation of the Lagos Plan of Action and Africa's Priority Programme for Economic Recovery (APPER) spared no efforts in sensitizing its member States on the importance of preventing and reducing post-harvest food losses. ECA convened several expert consultations/meetings on the issue and collected, through a questionnaire addressed to all African countries, as much data as possible on post-harvest food losses and in particular ongoing programmes. In 1982, the Commission convened the initial inter-agency meeting on food-loss prevention. It also incorporated in its work programme several projects aiming at improving food marketing systems in general and preventing post-harvest food losses in particular.

28. For instance, through the joint ECA/FAO Agriculture Division, the Commission implemented the following projects and programmes in this field:

(a) Study on food loss at storage points. The global study covered the whole region and aimed at reviewing the general situations analyzing the policy implications and providing a framework for improving planned programmes;

(b) Integration of women in the development process. Pilot project on the reduction of food losses. This project was of a pilot nature and covered Togo and Sierra Leone;

(c) Study on post-harvest food losses in fruits and vegetables. As a follow-up of the project on the role of women, ECA assessed the main causes and magnitude of losses of fruits and vegetables in Togo;

(d) Prevention of post-harvest food losses in Africa. This regional project is aiming at assisting member States and subregional intergovernmental organizations in their efforts in combating the two problems of post-harvest food losses and food shortages. The project has a subregional approach in scope and gives emphasis to main staples;

(e) Survey of constraints to improved storage facilities in Central and North Africa. This study formed the basis of a report which discussed the crucial issues pertaining to a significant reduction of food losses in storage and the salient factors underlying storage improvements. The report was presented to the seventh meeting of the Technical Preparatory Committee of the Whole in 1986;

(f) Prevention of food losses through insect pest management and use of small-scale and low-cost farm equipment. The project is a pilot scheme, aiming at introducing at small farmers' level integrated pest management methods for the control of crop pests. It is being implemented in collaboration with the International Centre of Insect Physiology and Ecology (ICIPE); and

(g) Seminars and workshops. The activities of the Commission related to post-harvest food losses are associated with seminars and workshops with a view to creating fora for the exchange of experience between African specialists. In this framework, a seminar on the reduction of post-harvest food losses in West Africa was organized in Lome, Togo in February 1987. For Eastern and Southern Africa, a similar forum is planned for May 1987, in collaboration with ICIPE. For the Central and North African subregions, seminars on the issue of reduction of post-harvest food losses are planned for 1988 and 1989 respectively.

29. The Action Programme for the Prevention of Food Losses (PFL) of the Food and Agriculture Organization was established in 1977 in Rome to assist developing countries and more particularly the least developed and the most seriously affected by food shortages in their efforts to increase food availability. The FAO programme on post-harvest food losses consists of practical projects including improving farm and village storage structures, promoting small-scale grain dryers and other improved processing tools and constructing and managing pilot warehouses. Although most of the projects under the Food and Agriculture Organization Prevention of Food Losses (PFL) programme are related to loss prevention in food grain, the Organization provided assistance to several African countries in preserving roots and tubers. FAO also provided valuable solutions in the elaboration of standard loss assessment methods and published quite a sizeable number of technical documents regarding various aspects of post-harvest food losses. All FAO practical activities included training components and national and regional seminars with a view to establishing a network of institutions involved in post-harvest loss prevention. Besides its national projects in most of the countries, the following activities were organized at the regional level:

(a) African regional programme of higher education in the prevention of food losses;

(b) FAO/IITA Training Workshop on post-harvest technology; and

(c) FAO/ARCT African Regional Workshop on national programming and inter-country co-operation in the prevention of food losses.

Table 4 gives the numbers and budgets of country projects (groups in subregion) and of regional projects implemented by FAO between 1977 and 1986.

Table 4: Country and regional projects undertaken by FAO between 1977 and 1986 in sub-Saharan Africa

Country projects in Subregions 1/	Number of projects and budgets in US dollars							
	Pipeline		Operations		Completed		Total	
	No.	Budg.	No.	Budg.	No.	Budg.	No.	Budg.
Central Africa (4 countries)	1	616,575	1	409,719	3	709,352	5	1,735.656
Eastern and Southern Africa (11 countries)	12	9,201,319	13	3,405,103	8	1,275,192	33	13,881,614
Great lakes countries (2 countries)	1	400,000	1	150,000	4	1,275,433	6	1,825,433
West Africa (15 countries)	8	4,455,858	6	1,489,084	23	7,690,355	37	12,635,297
Subtotal (32 countries)	22	14,673,752	21	5,453,916	38	9,950,332	81	30.076,000
Regional Projects	4	2,339,108	2	174,660	3	331,891	9	2,825,659
Grand total	26	17,012,860	23	5,628,576	41	10.262,223	90	32,903,659

Source: Extracted from FAO Prevention of Food Losses Programme data sheets, GASGA Project Catalog, compiled on 21/11/1986.

1/ In brackets are the number of countries concerned by projects in a given subregion.

30. Other United Nations organizations including those mentioned below have been actively involved, either directly or through funding, in activities related to prevention and reduction of food losses:

(a) The World Health Organization (WHO), in collaboration with Food and Agriculture Organization (FAO), established the Codex Alimentarius Commission in order to assist developing countries in food quality control;

(b) The International Fund for Agricultural Development (IFAD) supported several countries' projects and associated training programmes;

(c) The United Nations Environment Programme (UNEP) supported the FAO/WHO Codex Alimentarius Commission and initiated activities on fungal contaminants control in food;

(d) The United Nations Industrial Development Organization (UNIDO) implemented several country and regional projects aiming at improving post-harvest technology, including food storage and processing; and

(e) The United Nations Development Programme (UNDP) funded quite a number of the Prevention of Food Losses (PFL) projects executed by FAO, UNIDO and African national and subregional institutions.

4. Role of development agencies

31. Several development agencies, non-governmental organizations and international research institutes assisted African member States in their food-saving programmes. As not all of these organizations/institutions have widely publicized their activities, only the role played by some of them are documented here and more particularly that of the members of the Group for Assistance on Systems Relating to Grain after Harvest (GASGA) which is a voluntary association of organizations/agencies directly involved in tackling post-harvest problems. GASGA is a technical association of international character established in 1972 following a recommendation of a seminar on the storing of grain, particularly in the humid tropics which took place at Ibadan, Nigeria in July 1971. Presently, the association is composed of the following eight members:

(a) The Commonwealth Scientific and Industrial Research Organization (CSIRO);

(b) The Food and Agriculture Organization (FAO) of the United Nations;

(c) Deutsche Gesellschaft Fur Technische Zusammenarbiet (GTZ);

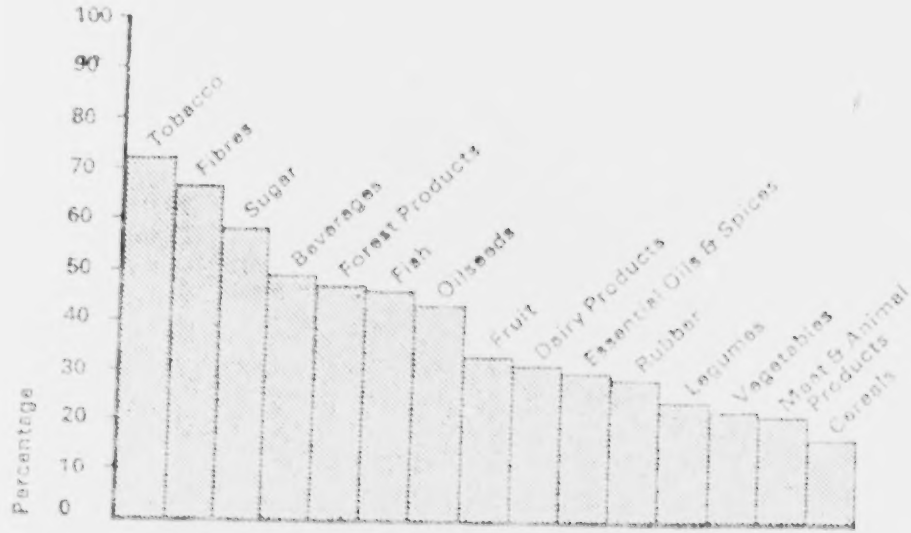
(d) The Institut de recherches agronomiques tropicales et des cultures vivrières (IRAT-GERDAT);

(e) Koninklijk Instituut voor de Tropen;

(f) The Food and Feed-Grain Institute of Kansas State University; and

(g) The Tropical Products Institute (TPI).

The proportion of the total value of each commodity group added post-harvest within LDC's—1970.



Source: Post-harvest improvements of the 1980s and 1990s, Proceedings of the tenth anniversary seminar of the CASGA, June 1981.

32. The members of GASGA have been involved in the provision of professional advice, the conduct of field projects, the training of personnel and the conduct of the research and its applications, in relation to problems of post-harvest systems in grain and other food commodities in developing countries including Africa. For example, it appears from GASGA projects data sheet that IRAT conducted 9 country projects in Africa; that GTZ is involved in 22 country projects, 2 regional projects and 5 supraregional projects and that IDRC is supporting 20 country projects in Africa. Also, the Tropical Products Institute which has the responsibility, within the British Overseas Development Administration (ODA), for assisting the least developed countries (LDCs) to overcome various aspects of post-harvest problems, has implemented in many African countries several projects related to food storage improvement, processing quality-control, post-harvest economics and food marketing.

33. Apart from the members of GASGA, some development agencies and more particularly from the OECD countries have significantly assisted member countries in the improvement of post-production systems. The United States Agency for International Development (USAID) funded two notable projects on post-harvest loss subjects. The first was a report prepared by an ad hoc advisory panel of the Board on Science and Technology for International Development, entitled "Post-Harvest food losses in developing countries" and the second resulted in a manual entitled "Post-harvest grain loss assessment methods", prepared by the League for International Food Education and the American Association of Cereal Chemists, with the assistance of several members of GASGA. In addition, USAID has provided assistance in many African countries through grain storage and marketing projects. Besides the above-mentioned contributions, the activities of some Africa-based international research institutions and some non-governmental organizations are worth mentioning. These include the International Institute of Tropical Agriculture (IITA), the West African Rice Development Agency (WARDA), the International Centre for Insect Physiology and Ecology (ICIPE). The voluntary organizations which provided valuable contribution in the improvement of post-harvest systems include the United States Peace Corps and the Volunteers in Technical Assistance (VITA).

B. Main aspects of improvements in the post-production systems

34. The importance of the results achieved will be different from one country to another depending on the prevailing situation, the traditional practices and the relative importance of the efforts made to overcome the shortcomings. Also since much attention was paid in general to food grains, the major achievements made are related to loss assessment, improvement of storage conditions and processing of grains. Relatively less improvement has been made for preserving perishables.

1. Improvement in loss assessment

35. It should be recalled that following the adoption of the resolution calling for a 50 per cent reduction of post-harvest food losses by 1985, an interdepartmental sub-committee was set up by the United Nations Secretariat to review past and current activities related to reduction of post-harvest food losses. The sub-committee concluded, inter alia, that:

(a) There is no agreed methodology of post-harvest loss assessment. Moreover, loss data are generally unrelated to the cost of loss reduction;

(b) There can be no agreed single figure for the percentage of post-harvest losses on a global scale or even on a national basis; and

(c) There is clearly a need for more accurate assessment of these losses, to establish firm justification for the development and introduction of measures designed to reduce them where the cost/benefit ratios of corrective measures are favourable.

The concern of the sub-committee was fully justified as in the past, loss estimates were not reliable and since any progress towards the goal of significantly reducing losses could only be attained if reasonable quantitative loss estimates were available. It was therefore necessary, as a matter of priority, to integrate activities aiming at reducing losses with the assessment of the nature, causes and magnitude of such losses.

36. For food-grain, the lack of standardized estimation methodology was rectified with the preparation in 1978 by Harris and Lindblad of the manual "Post-harvest grain loss assessment methods" (see annex IV). This reference manual has allowed research workers to carry out estimations in various locations in such a manner that results could be easily comparable. However, it appeared that estimated loss figures can vary from season to season for a given crop in a given location. The manual prepared by Harris and Lindblad has therefore been further elaborated and methods adopted to specific situations. Moreover, because obtaining precise assessment has been found highly expensive, the process of assessment has been adapted to requirements of projects and can range from a broad estimate to precise figures. Practically, it has been suggested that losses be assessed at the various stages of the post-harvest operations and precise estimation be made at the stage where the maximum losses occur. For perishables, although pilot attempts to establish methods of assessment have been conducted, no standardized methodology is broadly accepted at present. Improvement of loss assessment method has not only contributed to more loss estimate out of the realm of guesswork. Its continuous refinement, through pilot projects, has allowed proposals for alternative ways of reducing losses to be made in the light of cost/benefit ratios and enable progress in replacing traditional methods by improved practices to be monitored.

2. Improvement of storage conditions

37. As a result of its post-harvest loss assessment activities, FAO concluded in 1980 that more attention should be paid to storage because it is at this stage that losses are easily estimated, avoided or reduced. Also, with the increased attention paid to food security strategies in Africa, there has been a corresponding increase of resources allocated to improving both central and on-farm storage facilities. In the past, efforts to overcome storage problems in Africa were mainly aimed at killingpests, using a wide range of pesticides. In view of the fact that such methods were not suitable to farmers (particularly the small farmers) due to the cost of the imported chemicals and the danger they could cause, efforts have been oriented towards identifying solutions involving the existing farming systems. The goal was to improve storage structures so that stocks are protected against climatic effects (heat and humidity), post infestation and rodents attack. It has been unfortunate that early in the 1960s the technology package proposed to African countries

for improving storage structures was that developed overseas, proper for European products and farming systems and not in most cases, necessarily suitable to local conditions. Also in the past, priority has been given to urban central stores composed of modern warehouses or silos built of sheet metal or masonry, with corrugated iron roofs, supported by elaborate steel frames. Apart from the high costs of the construction materials which were totally imported, the lack of qualified technical and managerial manpower for the running of these structures made them inefficient. Later on, it became clear that preserving food stocks only at central storage level did not help to significantly reduce post-harvest food losses as about 75 per cent of the aggregated food production were retained on farms. Therefore, activities were geared towards improving on-farm storage. Some aimed at adapting the traditional structures and others aimed at developing new types of rural stores, taking into account important criteria such as local availability of materials, ease of construction, good thermal conditions, adequate ventilation and reliance on local labour for all construction work. The idea was to present the farmer with something appropriate to the environment, familiar to him in shape and easy to construct within his limited resources. For instance, very rapidly improved basket stores, mud brick-walled stores, mud silos, plastered ferro-cement stores have been successfully promoted in rural areas.

38. Not only have efforts been made to adapt stores to prevailing socio-economic and climatic conditions but also to improve rodent and insect control measures. Although the use of chemical pesticides was still recommended, efforts have been made to develop natural pesticides and to promote traditional pest-control methods. Furthermore, plant breeders have successfully included resistence to pests in selecting new varieties of staple seeds. Similarly to loss assessment, improvement of storage conditions concerned more food grains and less perishables. Attempts are being made to develop field grading and packing systems for fruits and vegetables and to adapt traditional barns, clamps, underground pits for storing roots and tubers. For fresh fish, experimental low-cost cooling, solar powered or not, is being promoted. The above-mentioned achievements clearly show that at least technically, substantive improvements of storage conditions have been made over the period.

3. Improvements in food processing

39. It is noteworthy that the main food grains that are easiest to grow in Africa (sorghum, millet, maize, rice) are difficult to be processed into ready-for-consumption forms. Using traditional methods, rural housewives spend from two to five hours per day on dehulling, winnowing and grinding grains by hand. Quite apart from the drudgery, the process brings about substantial losses. Therefore, improving both primary and secondary processing methods would have not only reduced losses but would also introduce the small farmer and especially his wife to a better way of life. Unfortunately, processing local food has received less attention during the past 10 years. As indicated in the following chart, the increased post-harvest value of main agricultural commodities remained low and more particularly as far as food commodities are concerned.

40. With regard to primary processing of food grains, including drying, threshing, shelling, hulling and winnowing, the sophisticated imported machinery developed for large-scale farming systems were simply beyond the means of

African farmers to acquire, operate and maintain. It is also true that research in agricultural equipment concentrated more on pre-harvest operations and less on post-production operations. However, some agricultural engineering institutes and appropriate technology development organizations made valuable work in designing and constructing simple types of machinery which are suitable and affordable to small farmers. The key problem has been that manufacturers in developed countries are no longer interested in the production of such machines considered obsolete and that the industrial section in most African countries is not able to build them. A list of some manufacturers of simple equipment for food grains primary processing is given in annex III.

41. With regard to secondary processing of food, less consideration was given to local produce. For cereal grains, small-scale milling machines for grinding millet, sorghum, maize after they are dehulled, have been developed and widely promoted in urban areas in most of the countries. Still the dehulling has to be done in the traditional way, by hand in most cases. It is only recently that dehuller machines were introduced in some countries. An example of such a machine is the PRL dehuller which prototype has been developed by an International Development Research Centre (IDRC) project in 1973 but introduced in some rural areas in the 1980s. Also more recently, since wet-milling has proved to lead to poor grinding (the resulting flour is saturated with water), mills for grinding dry cereals have been developed. Furthermore, multi-purpose mills which can process cereals and tubers are now available. Large-scale commercial mills have also been established in urban areas but mainly to process imported wheat, in most cases in sub-Saharan Africa, with the exception of Kenya, Zambia, the United Republic of Tanzania, Nigeria and Zimbabwe where such facilities have been used not only for wheat but also for maize. In these countries, multistage large-scale mills allowed the removal of the germ which is further processed to extract oil. This multistage process has the two advantages of producing a whiter flour which has a longer shelf-life and of producing cooking-oil and industrial starch and glucose in some cases. Apart from the development of milling facilities, it is unfortunate that the most popular agro-industry in Africa remains the breweries. Producing local beverages using local grains has also been found energy-consuming. Modern breweries are using imported malt and it is only recently that a little quantity of local grains is incorporated in the process. Also, making beer or other alcoholic beverages using local cereals is not a proper way of preserving food since the process simply halves the caloric value of the food used (the process simply inducing a net loss of 50 per cent). Processing local grains to nutritious food such as biscuits, breakfast meals, etc., has not been given the right consideration. It is only recently that bread making and post-production processes involving composite flours (replacing 5 to 30 per cent of wheat by millet, sorghum, maize and cassava flour) have been promoted.

42. For root crops, a breakthrough in processing has been principally made in the case of cassava. In West Africa in particular, the traditional manual methods of making gari and cassava flour have been mechanized and adapted to semi-industrial and industrial processes. In Nigeria, for example, various types of gari manufacturing lines have been developed and the most popular type was locally designed and built by FABRICO Nigeria Limited. Concerning fish processing, canning has been the major process of preserving fresh fish. The process has been more developed in North Africa and less in sub-Saharan Africa. Traditional methods of curing fish have been significantly improved. Solar dryers have been promoted and smoking has been mechanized in some countries. More recently, a Geneva-based association called "Technology for

the People" designed a new process of making flour of fish protein concentrate (FPC). With regard to fruits and vegetables, processing improvements have been limited to the development of canning facilities and solar drying. However, these methods are not widely developed in most countries.

III. CONCLUSIONS AND RECOMMENDATIONS

43. The chapter on achievements in preventing and reducing post-harvest food losses during the period from 1975 to 1985 clearly shows that the resolution adopted by the seventh special session of the United Nations General Assembly was fully endorsed by African member countries and the international community. All concerned parties have contributed to a better knowledge of the causes and nature of post-harvest food losses, to sharpening loss assessment methods and to the improvement of the situation which prevailed in the past. There is no doubt that presently most of the requisite knowledge for prevention of post-harvest food losses exists. However, the actual level of the losses remains high in many developing countries, including those in Africa. The key issue is therefore how the knowledge gathered during the past 10 years could be used to tackle the problems.

44. Measures taken by African member countries and the supportive activities undertaken by the international community towards the reduction of post-harvest food losses have had varying impacts, depending on the efficiency of national institutions established for the purpose and the socio-economic environment in each country. For instance, from various studies and surveys, it appeared that in 1985, volume loss of cereal grains procurred by the Grain Marketing Board in Zimbabwe did not exceed 1 per cent while in Chad, losses during the handling and storage were estimated to be as high as 20 per cent. Also in the past, magnitude of post-harvest losses of cassava was as high in Nigeria as in Rwanda. Although this commodity is a staple food in both countries, losses have been more significantly reduced in Nigeria than in Rwanda because improved handling and processing systems for this commodity have been widely promoted there. It has also been reported that in Mali, measures for improving storage conditions, associated with the national food strategy, contributed to the reduction of cereal losses from 12 to 7 per cent between 1980-1981 and 1983-1984. 3/ Furthermore, more resources have been generally allocated to improving storage facilities for export crops and urban central stores and less to improving village and on-farm storage facilities. Therefore, in spite of the commitment of African Governments to reduce post-harvest food losses, there has been in most cases inadequate infrastructure to implement a sound loss reduction programme in the rural areas. In addition the support that member countries received from the international community did not always produce the expected result due to the fact that in many countries related activities were generally dispersed in a number of official and non-official departments/agencies. Moreover, the right attention was not given to socio-economic aspects when conceiving related programmes. There is no doubt that the farmers' readiness to accept advice, their ability to pay for improvements, the benefit they may expect to get by adopting proposed improvements are the major factors in the successful implementation of any programme. Although there is no panacea for the practical reduction of post-harvest food losses and any programme should be considered in relation to local circumstances, it is proposed that future strategy focus on the following policy measures to be implemented respectively at the national, subregional and international levels.

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A. At the national level

45. In the spirit of Africa's Priority Programme for Economic Recovery (APPER) in which African member States reiterated their continued full commitment to the basic principles of the Lagos Plan of Action, Governments are primarily responsible for the economic development of their countries, including improving availability of food to their people by promoting agricultural development and reducing post-harvest food losses and waste. Not only must Government awareness of the importance of post-harvest food losses should be maintained, but also related activities must be integrated in member countries' agricultural development programmes and the following requisite elements should be made available to the extent needed:

(a) The establishment, where it does not yet exist, of a national post-harvest co-ordinating unit charged with the responsibility of food-saving programmes. For making the unit operational and efficient, adequate human and financial resources should be allocated to it;

(b) The availability of qualified technical staff and more particularly within the extension services. With regard to training of farmers, apart from the fact that women workers should be included in the extension programme, the training itself must be addressed more to rural housewives who are performing most of the post-harvest operations;

(c) The development of suitable marketing infrastructure and the provision of the right incentives to farmers. Infrastructural development would include the improvement of transportation systems in rural areas, the establishment of small packing stations and more particularly for perishables. Incentives to farmers would include attractive and timely remunerative price for good quality products and establishing a suitable financing mechanism to assist farmers and especially the resource-poor ones to adopt improved or appropriate technologies in harvesting, drying, threshing, winnowing and storing; and

(d) The promotion of research and development which embraces all aspects of the post-harvest systems and involving national universities and research institutions. Research and development activities would include the development of standardized loss assessment methods and ensure orderly and sound processing methods without neglecting some of the existing traditional methods.

B. At the subregional level

46. Due to the lack of adequate technical skills, equipment and financial resources, most African countries were not able individually to make a breakthrough in technological development for improving post-harvest operations. Subregional co-operation is however necessary to promote and strengthen research and development, design and engineering and the exchange of experience. Effective co-operative activities would require:

(a) The establishment of subregional institutions responsible for food strategies and charged with specific activities that are of common interest to concerned countries and whose implementation is beyond the means of an individual country. The African Regional Centre for Engineering Design and Manufacturing (ARCEDEM) could for instance give more importance to the development of post-harvest technologies in its programmes. Other areas of

importance should include technological development for food preservation and processing, testing pesticides and pest management and control methods; and

(b) The establishment of subregional post-production committees which will prepare and up-date inventories of post-production technologies of particular interest to the concerned countries; organize fora for exchange of information in order to ensure that innovations or improvements achieved in some countries could be beneficial to others facing similar problems.

C. At the international level

47. The efforts of the many international organizations, national development agencies and voluntary organizations, in support of activities related to post-harvest food losses in African countries, must be intensified. The valuable activities in loss assessment or aimed at a better knowledge of various tropical post-harvest systems have been useful but rather expensive. Future actions in assisting member States should be more action-oriented and should include the following:

(a) Continued co-ordination of activities not only related to cereal grains but also to perishables and more particularly to root and tuber crops which are equally important in the diet of African populations;

(b) Giving more emphasis to training since the capability of countries to implement practical programmes will depend upon the availability of qualified technical staff. Such training would include technology application, maintenance, adaptation and development and should be associated with seminars and workshops in order to facilitate exchange of information and promotion of international co-operation;

(c) Strengthening the technological capability of member countries in food processing methods and particularly in those adapted to processing local food commodities;

(d) While the scope of bilateral co-operation between developed and developing countries exists, linkages among developing countries should also be strengthened in this field; and

(e) The international community could provide member States with practical aid which could integrate actions aiming at reducing post-harvest food losses in the general technical and economic assistance.

48. Food losses would be significantly reduced if the whole post-production system including harvesting, processing, storing, handling, transportation and distribution is improved and should be viewed as part of overall development plans and programmes and not as isolated phenomenon. Unless efforts are intensified at all levels, including provision of adequate incentive packages in this field, the achievement of self-reliance in food will still remain an elusive goal on the continent.

Annex I

LIST OF COMMON INSECT PESTS IN RURAL AND URBAN CENTRAL STORES IN AFRICA

Insect pest		Susceptible commodity
Grain weevil	Sitophilus granarium	Wheat
	Sitophilus orizea	Rice
	Sitophilus zea mals	Maize
Flour beetle	Tribolium confusum	All cereals
	Tribolium castaneum	All cereals
Lesser grain borer	Rhyzopertha dominica	All grains in warm and humid countries
Khapra beetle,	Trogoderma granarium	All grains in dry and hot countries
Moth	Lepidoptera as Plodia, Ephestia, Sitotraga, Nemapogon	All cereals in warm and dump storage conditions
Flat grain weevil	Cryptolestes	Rice
Mites	Acarus siro and others	All grains in dump storage conditions
Dried beanbeetles	Acanthoscelides objectus Zabrotes subfascinatus	All pulses
Groundnut borer	Caryedon seratus	Groundnuts
Greater grainborer	Prostephanus truncatus	Maize on cobs

The order in which the pests are written down reflects more or less their importance in Africa.

Annex II

LIST OF SOME AFRICAN NATIONAL INSTITUTIONS INVOLVED IN THE IMPROVEMENT/DEVELOPMENT OF FOODGRAIN STORAGE AND PROCESSING METHODS

Institut de recherche agronomique tropicale et des cultures vivrières Niaouli	Benin
Rural Industries Innovation Centre	Botswana
Centre ivoirien de recherches technologiques Abidjan	Côte d'Ivoire
Technology Consultancy Centre University of Science and Technology Kumasi	Ghana
Garu agricultural station	Ghana
Department of Mechanical Engineering University of Nairobi	Kenya
Village Technology Unit Nairobi (Keren)	Kenya
African Rural Storage Centre International Institute of Tropical Agriculture Ibadan	Nigeria
Nigeria Stored Products Research Institute Federal Ministry of Trade Ibadan	Nigeria
Institut de technologie alimentaire Dakar	Senegal
Food Research Centre Khartoum (Shambat)	Sudan
Tanzanian Agricultural Machinery Testing Unit Arusha	Tanzania
Association pour le développement de l'animation Rurale Tunis	Tunisia
CEDECO Kimpese	Zaire
Mont Makulu Research Station Chilanga	Zambia

Type of equipment	Manufacture
	Projects Development Institute (PRODA), National Science & Technology Development Agency, 3 Independence Layout P.O.Box 609, Enugu Nigeria
	Société Ivoirienne de Technologie Tropicale (12T) 04 B.P. 1137 Abidjan 04 République de Côte d'Ivoire (Telex 3347) Telephone 33 23 60; 321 79)

Annex III

LIST OF SOME AFRICAN BASED MANUFACTURERS CONSTRUCTING TOOLS AND MACHINES PROPER TO POST-HARVEST OPERATIONS FOR TROPICAL PRODUCTS

Type of equipment	Manufacture
Treeshakers	SISMAP, Senegal RIIC, Botswana
Winnowers	SISMAR, Senegal Village Technology Unit, Kenya
Hulling machines	SISMAR, Senegal ABI, Côte d'Ivoire
Decorticators of groundnuts	SISMAR, Senegal ABI, Côte d'Ivoire
Maize shellers	SISMAR, Senegal Village Technology Unit, Kenya
Equipment for processing cereals	Nanchula Mechanical and Machine Tools Co. Ltd. P.O.Box 30, Kagbula, Morogoro United Republic of Tanzania
	Mwanza Engineering Works P.O.Box 507, Mwanza United Republic of Tanzania
	Mike Motors, Auto Engineers P.O.Box 207, Moshi United Republic of Tanzania
	D & P Investors P.O.Box 820, Mwanza United Republic of Tanzania
	Hanil Engineers Manufacturers of Maize Mills, Factory Area P.O.Box 1274, Arusha United Republic of Tanzania
Equipment for processing cassava	Agricultural Engineers Ltd. Ring Road, West Industrial area P.O.Box 3707, Accra Ghana
	Fabrico Nigeria Limited Lagos, Nigeria

Annex IV

SELECTED BIBLIOGRAPHY

Post-harvest improvements for the 1980s and 1990s. Proceedings of the tenth anniversary Seminar of the Group for Assistance on systems relating to grain after harvest (June 1981).

Post-harvest food losses in developing countries, National Academy of Sciences, Washington (1978).

Post-harvest grain loss assessment methods, developed and compiled by Kenton L. Harris and Carl I. Lindblad, American Association of Cereal Chemists.

Small farm grain storage, peace corps/VITA information collection and exchange, manual M-2.

Le contrôle de l'infestation des denrées stockés par Trogoderma Granarium et Prostephanus Truncatus, Compte rendu d'un séminaire international renu à Lome/Togo du 10 au 15 decembre 1985. Deutsche Gesellschaft fur Technische Zusammenarbeit (GTZ).

The lost harvest, Food and Agricultutre Organization (FAO).

Post-harvest losses in quality of food grains, FAO Food and nutrition paper No. 29.

Processing and storage of foodgrains by rural families, FAO Agricultural Services bulletin No. 53.

Prevention of post-harvest food losses: A training manual, FAO.

The Prevention of Losses in Cured Fish, FAO Fisheries Technical Paper No. 219.

Report of the Workshop on production and marketing constraints on roots, tubers and plantains in Africa, Kinshasa, Zaire, September-October 1985, vol. II, FAO.

Rapport d'une mission de consultation du 25 mai au 30 juillet 1972 sur les pertes alimentaires par G.G.M. Schulten, FAO.

Report on interagency meeting on food loss prevention and encroachment on arable land, Rome, 6-7 September 1983, FAO.

Survey of constraints to improved storage facilities in Central and North Africa, Economic Commission for Africa. Document E/ECA/CM.12/1.

Pre-feasibility study on integration of women in development: Pilot project on reduction of food losses (Case study: Togo), 1984, ECA.

The role of women in the marketing of fruits and vegetables in Togo. Pilot project on reduction of food losses, ECA, 1985.

Review of programmes and strategies of intergovernmental institutions to reduce food waste and losses in Africa, ECA, 1985.

Effectiveness of marketing institutions and services in reducing food losses in Burundi, Rwanda and Zaire (Kivu region). Regional project on prevention of post-harvest food losses, ECA 1986.

Technical Compendium on Composite Flours, technologies available for application, ECA, 1985.

Appropriate industrial technology for food storage and processing. Monographs on appropriate industrial technology No. 7, United Nations Industrial Development Organization (UNIDO), 1979.

UNITED NATIONS
ECONOMIC AND SOCIAL COUNCIL

Distr.: GENERAL
E/ECA/CM.13/11/Summary
6 February 1987
Original: ENGLISH

ECONOMIC COMMISSION FOR AFRICA

Eighth meeting of the Technical Preparatory Committee of the Whole

Addis Ababa, Ethiopia
13 - 20 April 1987

Item 6 of the provisional agenda*

ECONOMIC COMMISSION FOR AFRICA

Twenty-second session of the Commission/ thirteenth meeting of the Conference of Ministers

Addis Ababa, Ethiopia
23 - 27 April 1987

Item 5 of the provisional agenda**

REPORT ON MEASURES TAKEN BY AFRICAN COUNTRIES TO REDUCE POST-HARVEST FOOD LOSSES

Executive Summary

* E/ECA/TPCW.8/1.
** E/ECA/CM.13/1.

M87-306

1. The importance of post-harvest food losses in developing countries including in Africa was given the right consideration by the seventh special session of the United Nations General Assembly held in 1975. The Assembly adopted resolution 3362 (S-VII) which, inter alia, called for a drastic reduction of post-harvest food losses and recommended that the goal of 50 per cent reduction be attained by 1985. The African countries fully endorsed this resolution and included in the Lagos Plan of Action specific measures to be taken by all member States in order to practically prevent and reduce post-harvest food losses.

2. Such losses are commodity and location specific. For cereal and legume grains, they occur at every stage of the post-harvest system including during harvest, primary processing, transportation, storage and processing. With regard more particularly to stored food grains, the inadequacy of storage structures and the abundance of insect pests have been found to being the major main cuases of serious post-harvest food loss in Africa. As regard the damage caused by insect pests, Trogoderma granarium and Prostephanus truncatus are becoming a serious calamity since the first pest inflicts important losses to stored grains in the chronic food deficit countries of the region (mainly in the Sudano-Sahelian zone) and the second is a real threat in the promising maize growing areas (in Eastern and Southern Africa and in coastal West Africa). Besides food grains, root and tuber crops and fruits and vegetables are subject to high losses due to their perishability. Also, losses in fishery products are considerable even in cured products which are intended to be stored for some time.

3. Measures taken by member States to tackle this preoccupying problems included mass-media sensitization campaigns, the establishment of institutions charged with the responsibility of implementing post-harvest loss-reduction programmes, the improvement of operations of the food marketing boards, strengthening the extension services and developing or adapting post-harvest technologies including food processing facilities. At the subregional and regional levels, some attempts in co-operative programmes of improving post-production operations have been made. The efforts of African countries in reducing and preventing post-harvest food losses were significantly supported by:

(a) International organizations including the Economic Commission for Africa (ECA), the Food and Agriculture Organization (FAO) and some other United Nations agencies which intervened either directly or indirectly in the related programmes;

(b) Development agencies which collaborated for the purpose of reducing post-harvest food losses, and principally regarding cereal grains, within the Group of Assistance on Systems Relating to Grain after Harvest (GASGA);

(c) Voluntary non-governmental organizations.

4. Although the measures taken by member States and the supportive programmes implemented by the international community have brought about positive results

in improving the post-production operations, the issue remains of great concern in 1986 as various ongoing programmes reported that present losses are still important in many cases. Actual losses range from about 1 to 3 per cent for cereal grains in some countries to about 20 per cent in others. Also during the past 10 years, more resources have been allocated for improving central storage structures and less for village or on-farm stores. Moreover, most of the activities in the past concentrated on reducing losses in cereal grains and less has been done for preserving perishables. The question on whether the target of 50 per cent reduction is attained by 1985 is rather difficult to respond to.

5. If there is no doubt that, during the period 1975 to 1985, the requesite knowledge on how to prevent post-harvest food losses has been gathered, tackling practically the problem is yet to be achieved and will require that efforts are pursued. Although there is no panacea in reducing post-harvest food losses, it is proposed that:

(a) At the national level

(i) the awareness of decision makers of the importance of post-harvest food losses be maintained;

(ii) member States integrate food loss-reduction programmes in national agricultural development programmes;

(iii) Governments establish functional co-ordinating units charged with all related activities;

(iv) training activities be intensified in order to make available the required technical skills.

(b) At the subregional level

(i) member States co-operate in programmes aiming at the development and adaptation of post-production technologies proper to local food commodities;

(ii) post-production committees be established to ensure an effective exchange of information.

(c) At the international level

(i) the efforts of international organizations, development agencies and voluntary organizations be pursued, intensified and better co-ordinated;

(ii) programmes related to preventing and reducing post-harvest food losses be geared towards strengthening the technological capability of member States, or only through bilateral arrangements between them and developed countries but also with other developing countries;

(iii) the practical aid provided to member States to reduce post-harvest food losses be integrated to the general technical and economic assistance.